Quantum Paradigm for Social Governance

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INTRODUCTION

I find it remarkable that there are recurrent parallels between issues of public policy and physical descriptions of fundamental reality, especially quantum realities. The quantum universe is not the comfortable, clearly defined place we often think the world to be. It is full vagaries, contradictions, and complex patterns of behaviour that, like a magician's handiwork, create wondrous things before our very eyes, as long as we don't look too closely. And when we do look closely, those wonders dissolve into thin air, leaving us all marvelling at the magician's skill.

Quantum physics and social governance seem so far apart that one might expect only coincidental relevance between them. Quantum physics represents the pinnacle of scientific thought -- objective, exact, and predictive -- yet those achievements are obtained through its reliance on more characteristically subjective qualities -- dynamism, uncertainty, and non-linearity (Davies, 1984:104-112). On the other hand, the study of social governance is an inexact science, that attempts to describe the collective behaviours of unpredictable, often irrational human inclinations in the context of rational objective framework. What we perceive as two decidedly different phenomena, might they be two complementary expressions of the same underlying homology?

A constant theme in physics is that Nature is intelligent, it expresses order in every event no matter how big or small. According to Nobel physicist Stephen Hawking, "t*he whole history of science has been the gradual realization that events do not happen in an arbitrary manner, but that they reflect a certain underlying order*...." (Hawking, 1990:122). That order may not always express itself in terms of linear causality, as quantum physics has clearly demonstrated, but it is orderly none the less. Considering that social governance falls within the domain of the universe and is therefore subject to its laws, it is only sensible to believe that an economical Nature might apply some of the same rules to organize society as it does to organize the physical universe. In this paper I wish to examine this possibility.

The task I have set for myself is twofold. In **Section 1**, I will present a review of some basic ideas from quantum physics and some of the generally accepted ideas at the cutting edge of physics. I will explore the character of quantum reality and the rules of intelligence which govern it without going too much into rigorous mathematical detail. In **Section 2**, I will examine some of the shortcomings of the social governance paradigm in common currency and see if a comparison with the quantum paradigm provides any advantage. Finally, I will examine the possibility of some cross over between physics and public policy that might provide a better way of understanding the many divergent elements of business-government-society (BGS) relations.

Since the quantum reality differs sometimes quite dramatically from our everyday experience, I will begin **Section 1** with a synopsis of that everyday reality typified by the view of classical physics.

SECTION 1- PHYSICS PARADIGMS FOR PUBLIC POLICY

Classical Physics

The world view of classical physics is best represented by the work of Sir Isaac Newton. That world view involved solid distinct bodies, straight line motions, causality, and fixed constants that ruled all physical events. In essence, world was as we saw it and with the application of a little reasoning it was within the grasp of learned men to understand it all.

The basic units of the Newtonian world were solid, indestructible, material particles. By Newton's time there were the already observed planets but these heavenly 'particles' were ultimately to be understood as being formed of similar but minutely smaller indivisible units that the ancient Greek Democritus called 'atoms' -- small little round balls which acted much like miniature planets. Newton believed that there were fixed laws by which material bodies, both big and small, moved, and that these laws accounted for all observable change in the physical world. Newton thought all that happened had a definite cause, and/or gave rise to definite effects. In fact, to him the future of any system could be known with absolute certainty, if only its current state could be known in all its details. It is a view not unlike that of a billiard game with the nature of events being described by the interactions of the balls, with space represented by the table on which these events take place, and time represented by the score which creates the causal history. If you know A, B and C and how A interacts with B you can determine how B will interact with C.

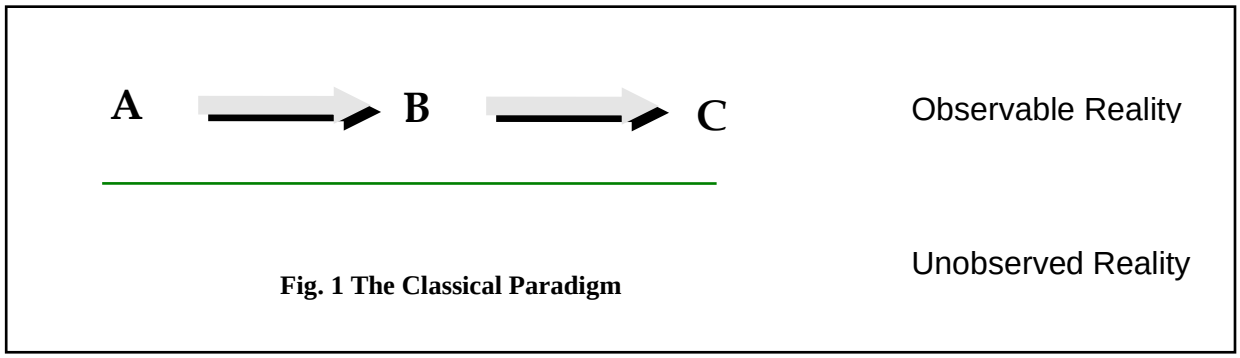


Fig. 1 The Classical Paradigm

"*The stage of the Newtonian universe, on which all physical phenomena took place, was the three-dimensional space of classical Euclidean geometry. It was an absolute space, always at rest and unchangeable ... All changes in the physical world were described in terms of a separate dimension, called time which again was absolute, having no connection with the*

material world and flowing smoothly from the past through the present to the future" (Capra, 1979).

According to the Newtonian paradigm in describing natural phenomena reference to a human observer was wholly unnecessary. What was the need to include an observer in world events that unfolded independently of any observer? Yet what began as a common sense assumption of convenience became a sort of religious tenet of the emerging scientific community – real science was objective and independent of subjectivity. This objectification of the natural world became in time the paradigm of all science, creating a dichotomy between objective and subjective universes that continues to this day. This was because the initial success of Newton in describing what happens in the world inspired thinkers in other fields such as chemistry and biology -- even in economics and political science – to adopt and to hold as doctrine the Newtonian world view long after its pre-eminence had been eclipsed in modern physical science.

Although this mechanistic 'billiard ball' view of the universe still persists, the laws of nature described by classical physics (such as Newton's law of gravity) have proved over time to be only approximations of what was really going on in the universe. In understanding the simple events of our daily lives, the knowledge and application of these classical rules -- such as force, inertia and gravity -- will do us just fine. However, when we begin extending the range of our senses and dealing with the very large dimensions of astrophysics and cosmology or the very small dimensions of the atomic or sub-atomic realms, the classical rules break down, allowing other more intricate, richer and more powerful laws of nature, the quantum laws, to be observed to be at work.

Are these quantum descriptions of nature important? Aren't Newton's laws good enough? Does anybody beyond cosmologists and theoretical physicists really care about this non-classical level of reality? Actually, it is important to each of us, every day. Three of our senses -- smell, sight and hearing -- are known to respond at levels where quantum effects become significant (Bialek & Schweitzer, 1985; Bialek, 1985; Baylor, et.al., 1979; Baylor, et.al., 1980; Bouman, 1961; DeVries & Stuiven, 1961). When we activate the laser in our CD-ROM, or take a phone call that has come over fibre optic cable, the properties of laser light are quantum based. When we use our computer and utilize so many transistor-like connections existing on one small VLSI silicon chip, we are making use of these deeper, more fundamental laws of nature. But maybe more important is the shadow still cast by Newton over other areas of human thought that still cling to the absolute correctness of Newton's classical paradigm long after it has been discarded by working physicists. And as this paper hopes to show, human behaviour and human systems of organization predominantly also reflect these deeper laws of nature.

Summary of the Classical Physics Paradigm

- events and things exist, and they exist independently of people;
- external observables and processes are important for knowledge -- the observer is not;
- everything can be broken down into fundamental units and their behaviour described by exact laws;

- the environment, space, and time have absolute existence and are the arenas for events;
- events proceed in a linear fashion through time;
- force is the energy applied to overcome a resistance to change;
- certainty is possible;
- the world is as we see it. It conforms to our preconceptions even beyond the limits of everyday experience;
- if a man knows the ‘stuff’ of the environment, then he can, like a potter, be the shaper of his environment and the environment will conform to his will.

Quantum Reality

As our senses have become extended by virtue of various technologies into the realm where quantum rules apply, we begun to 'see' a very different world, one which simultaneously 'is' and 'is not'. One which is both here and there. One in which everything is uncertain and variable -- even time. And although we frequently describe what we have experienced as 'seeing' we are not really 'seeing' in the traditional sense, but conceptualizing on the basis of vast sets of data and abstract mental maps.

Nature of Matter

The first big eye opener in quantum physics had to do with the nature of matter. At the level where quantum effects are generally witnessed, approximately 10^{-21} m (that is 0.00000000000000000001 meters), matter loses its solidity. Molecules have given way to atoms, and atoms have given way to 99.999 percent empty space, space that is permeated by waves of invisible and intangible energy. Everything we knew or presumed to know to be 'solid' has become as void as intergalactic space.

At sub-atomic levels matter does not really exist with certainty at definite places, but rather shows only a 'tendency to exist'. Quantum events do not occur with certainty at definite times or in definite ways, but rather show a 'tendency to occur'. In the formalism of quantum theory, these tendencies are called probabilities and what we previously assumed was a solid 'particle' is considered a probability wave of energy, expressing the probability of finding the particular 'package of energy' at a particular point in space and time. The introduction of probability waves was the first big success for quantum theory because it accounted for observations of matter and energy as sometimes behaving wave-like and at other times particle-like, observations that had puzzled physicists for many years. Nowadays, we understand that all the fundamental 'particles' of nature we observe behave sometimes like waves and sometimes as point-like 'things' depending on how you want to look at them and the tools you use.

"*At the sub-atomic level, the solid material objects of classical physics dissolve into wave-like patterns of probabilities, and these patterns, ultimately, do not represent probabilities of things but rather probabilities of interconnections ... between the preparation of the experiment and the subsequent measurement*" (Capra, 1979). And as physicist Paul Davies describes, "*The wave aspect corresponds to software, or mind, or information, for the quantum wave is not like any sort of wave anybody has ever encountered. It is not a wave of substance or physical stuff, but a wave of knowledge or information*" (Davies, 1983: 107).

An important aspect of this wave-like property of matter and energy is that, unlike a particle which may be said to move from one place to another, the wave medium remains stationary while energy is moved through the medium from one point to another by virtue of the medium's oscillations.

"*Because of the relativistic nature of sub-atomic particles, we can not understand their properties with out understanding their mutual relationships, and because of the basic*

interconnectedness of the sub-atomic world, we shall not understand any one particle before understanding all the others." (Capra, 1979: 216)

Surely, we are still dealing with just very tiny things, right? Wrong. Almost everyone is aware of the equivalence of mass-energy from Einstein's famous equation **E=mc²** equation. What this compact expression says is that mass is not the 'stuff' of the universe as Democritus and Newton would have believe, but it is congealed four dimensional 'space-time' whose space aspects make it appear as an object and whose time aspect makes it appear as waves of energy. The existence of matter and its activity can not be separated. "*The basic elements of the universe are dynamic patterns; transitory stages in the constant flow of transformation and change*..." (Capra, 1979: 215)

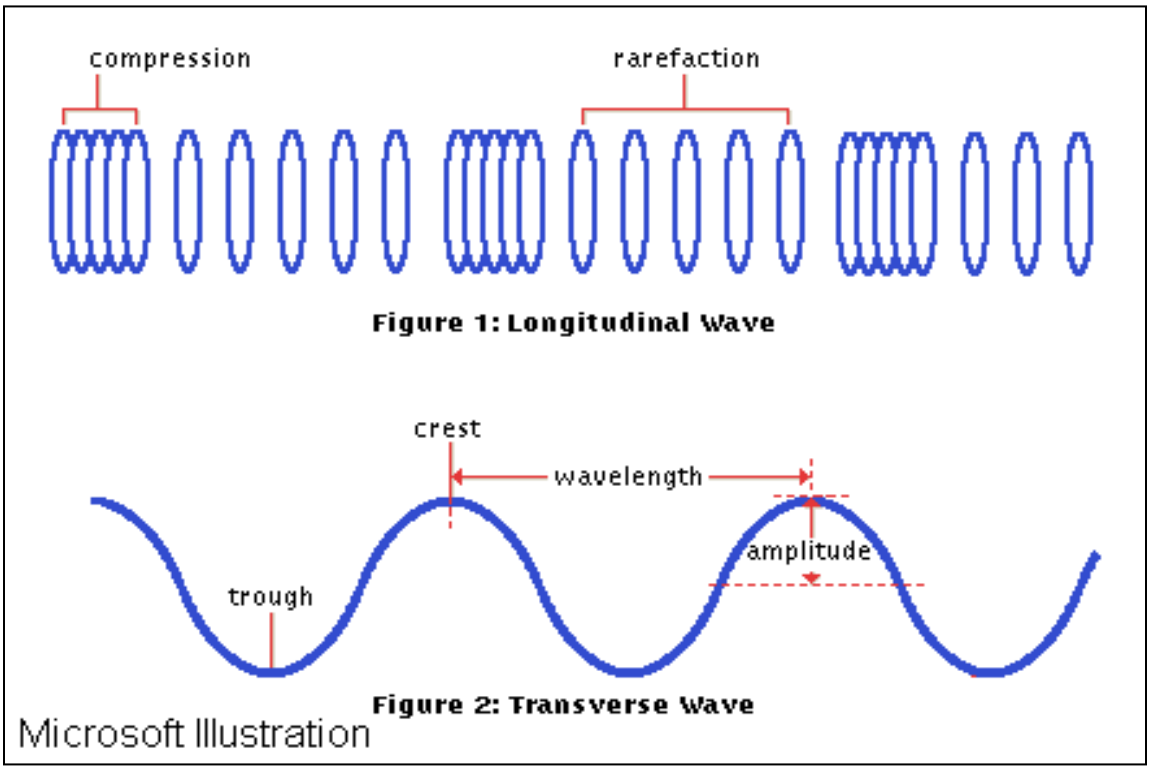


Fig. 2 - Electromagnetic radiation (eg light) exhibits transverse wave nature
From Microsoft Encarta, 1994

It is a peculiar effect of quantum theory that the confinement of 'particles' or energy packages to smaller regions of space leads to an increase in their energy output or vibration. The more you try to define a wave, or isolate it, the more energetic it becomes. "*According to quantum theory, matter is never quiescent, but always in a state of motion... The closer we look at it the more alive [matter] appears*" (Capra, 1979: 204). This then leads to a fundamental quantum property of Nature -- at smaller time and distance scales there is increasingly more energy and dynamism present; and at the smallest time and distance scale, the Planck scale (10^{-43} sec and 10^{-33} cm) the intrinsic energy and dynamism of Nature is, for all intents and purposes, infinite. This dynamic

aspect of matter arises in quantum theory as a consequence of the wave nature of particles, and as Relativity Theory describes the fact that matter can not be separated from its activity.

Wherever there is an object there is also a gravitational field (this best observed in massive bodies like the earth or the sun) and the very nature of this field deforms or changes the curvature of the space-time surrounding the body. Thus, objects have actions associated with them, that is, they change the stage or reference points in which they exist. Further, the energy implied by a gravitational field ***is nothing other than curved space***, making the matter and the nature of the space it occupies completely inseparable. Capra concludes that "*... material objects are not distinct entities, but are inseparably linked to their environment; ... their properties can only be understood in terms of their interaction with the rest of the world*." (Capra, 1979: 219)

As we shall see later in quantum field theory, a more recent development applies quantum principles to link fields like electromagnetism and gravity, minimizing the distinction between particles and the space surrounding them even further, and where we find that space that is empty of all stuff (referred in physics as *the vacuum)* is recognized as a dynamic quantity of paramount importance to the existence and evolution of the universe as we know it.

In modern quantum physics, we have the curious situation of trying to understand what we normally know as solid matter as essentially empty space and what we thought of as empty space assuming a dynamic existence that is inseparably linked to what we thought was solid.

Nature of Events

All quantum interactions involve the creation and destruction of particles. For instance, every particle has a corresponding anti-particle of equal mass but opposite charge. Electrons (**e-**), one of the more familiar 'particles' have anti-particles called a positrons (**e+**). Interactions between these 'particles' are mediated by photons (**γ**). The space-time diagram depicted below is a

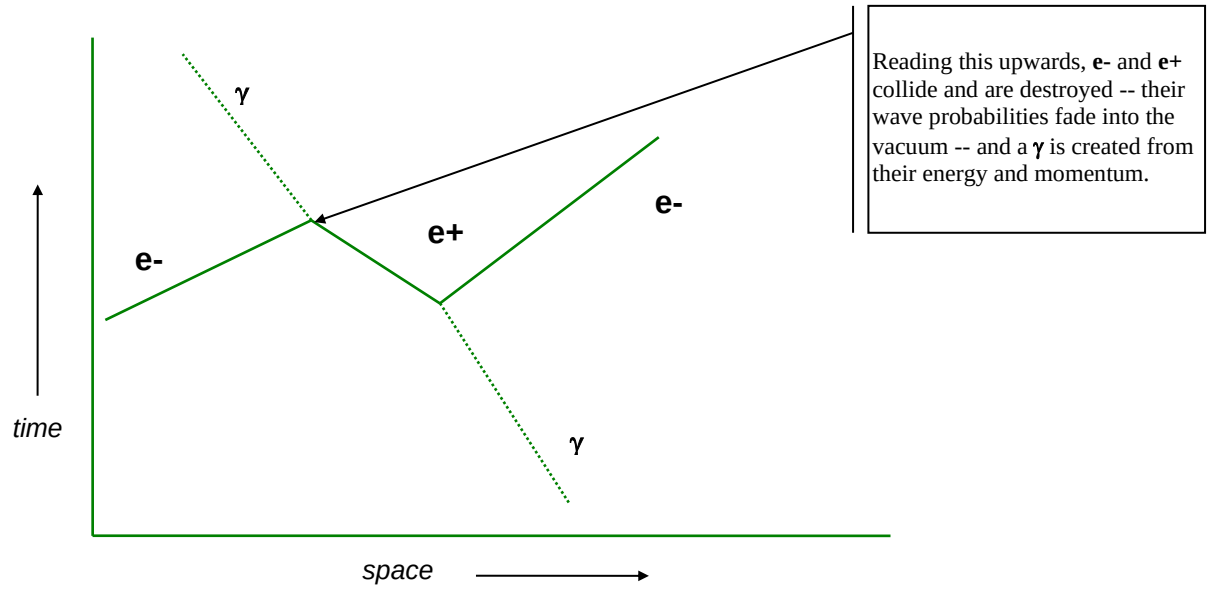


Fig. 3 - Space -Time Diagram

physicist's short-hand way of accounting for quantum events, such as electron-positron interactions. Its axes are one dimension of time vs. the three dimensions of space. It is best viewed not as a chronological record but as a four-dimensional pattern in space-time representing a network of inter-related events. It is usually read from bottom to top but can also be read from top to bottom or side to side. Each direction represents a valid quantum event. Although not a typical view, positrons can be seen (if you read this left to right) as electrons moving backwards in time.

Capra suggested that if we want to properly picture the interactions of space-time, we should do so as a 'four dimensional snap-shot' covering the whole span of time as well as the whole region of space. "*As we penetrate into matter, nature does not show us any 'isolated building blocks', but rather appears as a complicated web of relations between the various parts of the whole*" (Capra, 1979). In other words, to understand events we must consider them not in isolation but rather in the context of the whole network of interactions in which they are embedded.

Discreteness Not Distinctness

The reason why Nature appears to be so particulate to us is because of another fundamental property of the quantum world. Changes in Nature are not continuous at small scales but occur in precise bite-sized chunks or '*quanta*'. When an electron wave orbits an atomic nucleus, for example, it must do so as a standing wave representing discreet amount of energy. If this were not so, the electron wave would interfere with itself destructively and cease to exist. If an electron moves from one energy state to another it must do so by either emitting or absorbing a discreet amount of energy, a quantum of energy. There is, however, a minimum energy level from which no further reduction is possible. The basic units in quantum physics are thus the 'quanta' of energy required to maintain a stable wave state but also give rise to the impression that matter has certain indivisible chunks.

Uncertainty Not Determinism

One of the most important principles in quantum theory is Heisenberg's principle of *uncertainty*. It spells out that in any observation of events in Nature, there are limits to obtaining exact information about an event.

According to Heisenberg the more precisely you want to localize a 'particle', that is the more you want to confine a wave packet to a smaller region, the less certain you will be about defining the particle's momentum and vice versa. If you fix the position exact enough so that the 'particle' becomes still, it loses all momentum. If you try to exactly measure a particle's energy or momentum then you'll never be able to know exactly where it is. This limitation of ultimate certainty is a limitation of principle not of measurement. One can measure an object's exact position or its exact energy but not both at the same time. Similar relations exist between time (temporal location) and energy as physicists have observed that. events occurring in a short space of time involve a large uncertainty of energy and events with a precise energy can not be localized in a single instance of time.

Due to the limits of the uncertainty principle, events can not be predicted with absolute precision contradicting one of the fundamental assumptions of classical physics. Predictability is for the commonplace world but for the real world knowing A and B and their interaction will not predict B's interaction with C. In the quantum world linearity gives way to complexity not unlike the 'wicked policy issues' experienced in the governance arena that seem to shift and change as we try to pin them down and understand them. Ultimately, the more exacting our description becomes of one aspect of a quantum event, the more uncertainty is introduced into other aspects of the event. The result is that we have to settle for working approximations, because our Newtonian concept of objects isolated from each other and from us as observers do not conform to a universal reality compromised of networks of unlocalized relationships.

According to Hawking, "*These quantum theories are deterministic in the sense that they give the laws for the evolution of the [probability] wave over time... The unpredictable random element comes in only when we try to interpret the wave in terms of positions and velocities of particles*" (Hawking, 1990: 173). In other words, the uncertainty develops when we try to impose our classical (*read everyday)* world view on a universe that is not classical in its essential nature. When we try to squeeze the proverbial square peg into the round whole we only get a rough approximation of a fit.

Then again from Capra "*...the concept of a distinct physical entity ... is an idealization which has no fundamental significance. It can only be defined in terms of its connections to the whole, and these connections are ... probabilities rather than certainties. When we describe the properties of such an entity in terms of classical concepts ... we find that there are pairs of concepts which are interrelated and cannot be defined in a precise way. The more we impose one concept on the physical 'object', the more the other concept becomes uncertain...*" (Capra, 1979: 164).

In the end there is one thing physicists are certain of and that is "*...the uncertainty principle is the fundamental feature of the universe we live in*" (Hawking, 1990: 155).

Non-Linear Events

"*All events [in space-time] are interconnected, but the connections are not causal... interactions can be interpreted in terms of cause and effect only when the space-time diagrams are read in a definite direction*" (Capra, 1979: 196). When taken 'en bloc', there is no before or after, and therefore, no causation.

This lack of causality in the quantum world gets even more pronounced when physicists apply quantum principles to gravity. The classical formulation of gravity found in Einstein's General Relativity suggests that energy has mass (from $E=mc^2$) and at the intrinsically high energies present at quantum scales there is a self-interacting gravitational effect. This effect deforms space-time to such an extent that it begins to curve back on itself in a bubbling cauldron of space-times, more reminiscent of a foam-like nature than any uniform distribution. Time and distance have no meaning at this level, due the simultaneous coexistence of all possible geometries. If you can't determine your geometry, you can't know which yardstick to use, and if you can't measure space or time, then what good is it talking about them.

Without reference to time or distance, our conception of what comes before (the 'cause') fails completely and so the idea of causality also becomes a meaningless concept. The idea of "*causation is an idea which is limited to a certain experience of the world and has to be abandoned when that experience is extended*" (Capra, 1979: 196).

For example, in the quantum event depicted below, event A results in event B but the path from A to B is a superposition of all possible wave paths (*which is why it is shaded*) with the one we observe in a classical sense being the result of constructive interference along the path of least action. The other paths cancel out due to destructive interference.

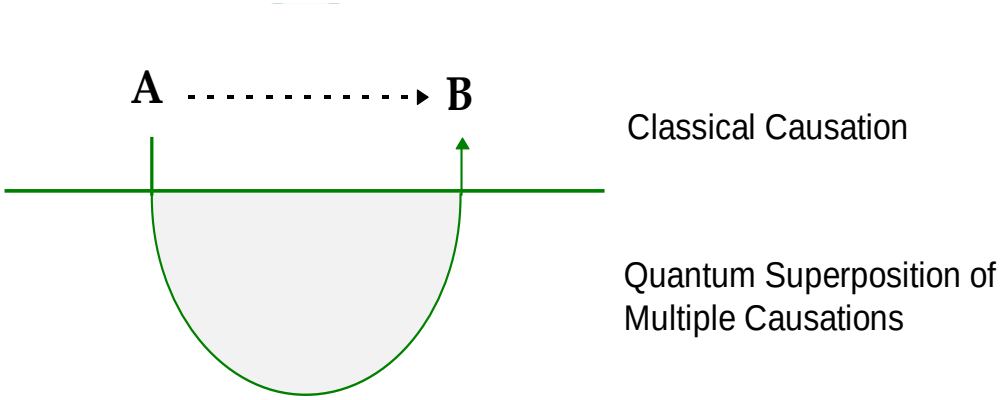
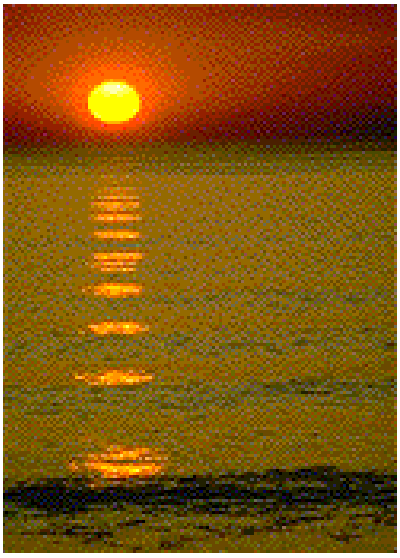


Fig. 4 - The Quantum Event, adapted from Chopra, Deepak, *Quantum Healing*,, 1997: 97

"*It seems plausible that multiply-connected geometries could result in non-local influences. Hawking identified one such class of effects that appears to require a non-local interpretation. He has demonstrated that initially pure quantum-mechanical states can evolve into mixed states as they propagate through a background of gravitational 'knots'...*" (Hagelin, 1986: 38).



What this means is that events at A can have an influence on B without there being the possibility of a causal link between them. Imagine an ocean with its innumerable waves. Each wave remains separated from every other wave by the time it takes for some disturbance to be carried through the medium of the ocean. In the case of physics, this time is the time it takes for light to travel between two points in space. Two events can be causally connected in time if and only if light can travel the distance between them in the prescribed interval of time. If not, the events can not be causally connected.

In the case of non-local effects, spatially separated waves can be influenced simultaneously without the disturbance having to travel through time and space. Physicist J.S. Bell devised a theorem that rejected models which depended on 'locality', a theorem that was

successfully tested in 1982 and demonstrated that the common sense world we perceive is "*supported by an invisible reality which is unmediated, unmitigated, and faster than light*" (Hebert, 1985:227). Since the world is a quantum world, "*all systems that have once interacted in the past ... are linked into a single waveform whose remotest parts are joined together*" (Hebert, 1985: 223). In 1984, Hawking pointed out that the evolution of the universe, from its initially 'pure' unmixed quantum state to its currently 'mixed' states, requires this non-local framework.

Interconnectedness of Everything

Continuing with this analogy of an ocean, each wave appears to have its own independent existence -- but are they really independent? If we consider the waves as excitations of the ocean itself, there can be no real independent existence given to individual waves. All the waves are not only connected, they are the ocean, or more precisely, a state of the ocean. This is precisely the case of particles and quantum events. Events, even though far apart, can not be treated as separate systems. At the deepest levels of quantum reality, every point in the universe is connected or correlated to every other point. They exhibit infinite correlation. All objects and events in the cosmos are inter-connected and share information with one another and respond to one another's changes of state. The reality of the universe is that it is non-local. Events do not have to follow a linear route of cause and effect because, like the waves of the ocean, events and things in nature are excitations of a more fundamental reality which like the ocean doesn't go anywhere. Once in the system, information is shared everywhere.

"*In modern physics, one has now divided the world not into different groups of objects but into different groups of connections... What can be distinguished is the kind of connection which is primarily important in a certain phenomenon... The world appears as a complicated tissue of events, in which connections of different kinds alternate or overlap or combine and thereby determine the texture of the whole*." - Werner Heisenberg (in Capra, 1979: 277)

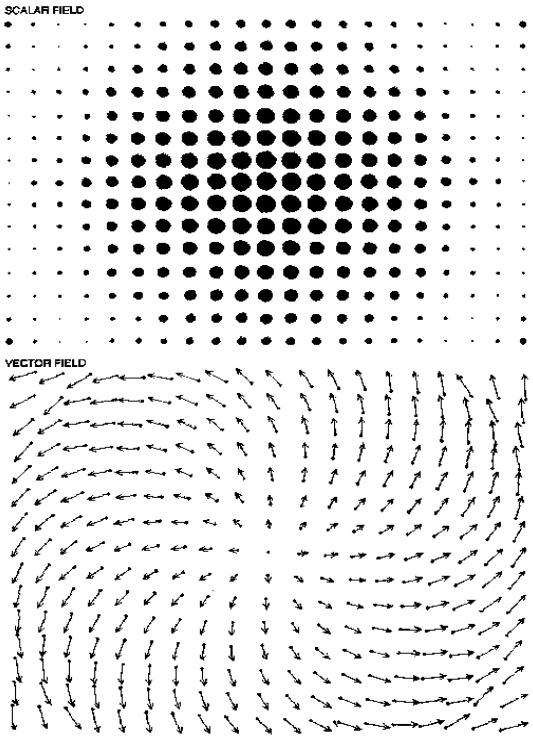
"*In the new world view, the universe is seen as a dynamic web of inter-related events. None of the properties of any part of the web is fundamental; they all follow from the properties of the other parts, and the overall consistency of their mutual inter-relation determines the structure of the entire web*." (Capra, 1979: 302)

The Quantum Field

At this point it is probably important to discuss what physicists really mean by fields and, in particular, quantum fields. Technically, the field concept simply defines some value at every point throughout space-time. A field is an abstract unlocalized entity that supports waves of excitation. Scalar fields, like temperature, have only quantities associated with each point, and vector fields have both quantity and direction defined. In the field theory of quantum electrodynamics, the concept of a quanta of electromagnetic energy, i.e. photons, is subsumed into a quantized vibration of an electromagnetic field. Returning to the example of the ocean, the waves are the quantized states of the ocean. The difference between the ocean and a field is that the field is more abstract, its medium is knowledge or information rather than water.

"*The quantum field is seen as the fundamental physical entity; a continuous medium which is present everywhere in space. Particles are merely local condensations of the field; concentrations of energy which come and go, thereby losing their individual character and dissolving into the underlying field*" (Capra, 1979: 221).

"*According to the [field theory of matter] a material particle, such as an electron, is merely a small domain of the electrical field within which the field strength assumes enormously high values, indicating that a comparatively huge field energy is concentrated in a very small space. Such an energy knot, which by no means is clearly delineated against the remaining field, propagates through empty space like a water wave across the surface of a lake; there is no such thing as one and the same substance of which the electron consists at all times*" Hermann Weyl (in Capra, 1979: 224).



*** From Martinus Veltman, <u>The Higgs Boson</u>, *Scientific American*, 1986**

Symmetry

Symmetry is an important concept in physics and can be defined as an invariance in the pattern that is being observed when some transformation is applied to it. A snowflake, for example, shows symmetry if it is rotated by increments of 60°. An electron in a group of electrons would look and act the same if the polarity of all of them were reversed simultaneously. The laws of nature are said to be symmetrical if they remain unchanged given some transformation. These examples of rotations and charge symmetries are examples of global symmetries, that is, they remain symmetrical if the change occurs everywhere at the same time. More important in physics are local symmetries, ones in which changes can be decided independently at every point in space and time. If we want to make a change in polarity of an electron, for example, at only one place, the laws of nature would remain the same only if we were also to affect the point with a magnetic field. The combination of electric and magnetic fields interpenetrating each other acts in such a way that the local symmetry is restored.

"*The presence of matter is merely a disturbance of the perfect state of the field at that place; something accidental, one could almost say, merely a 'blemish'. Accordingly, there are no simple laws describing the forces between elementary particles...Order and symmetry must be sought in the underlying field*." - Joseph Needham (in Capra, 1979: 225).

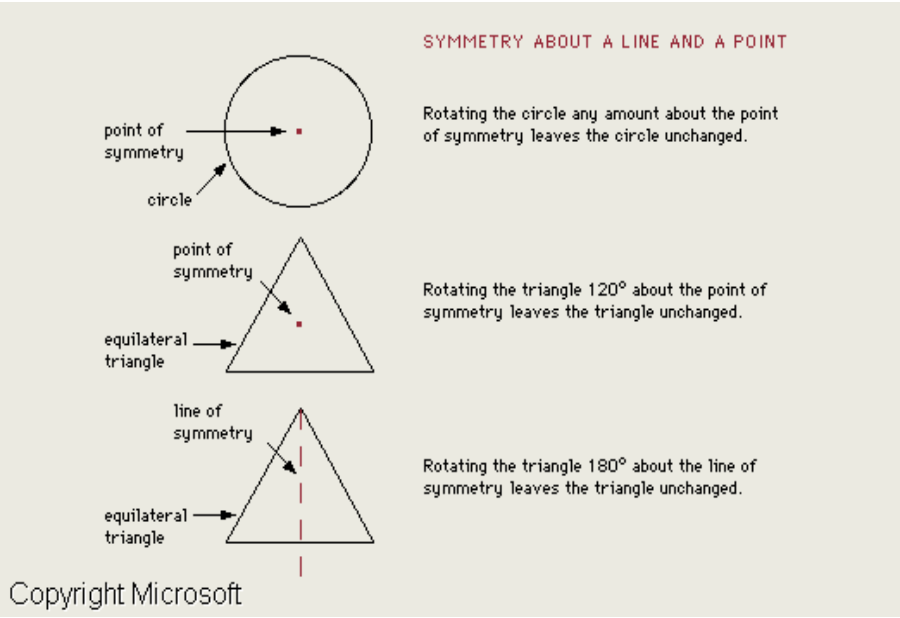


Fig. 6 - Rotational Symmetry, from Microsoft Encarta, 1994

Four Basic Conservation Laws

Whenever a particle displays a certain symmetry, there is a measurable quantity which remains constant or is 'conserved'. The four basic conservation laws in physics are:

- all events are symmetric with respect to displacements in space, i.e. conservation of momentum;
- all events are symmetric with respect to displacements in time i.e. conservation of energy;
- all events are symmetric with respect to their orientation in space i.e. conservation of rotation;
- conservation of electric charge

With respect to the quantum fields, when the internal symmetries of the field, such as phase angle, can be adjusted arbitrarily at each point in space-time, they are called gauge symmetries. The absolute value is irrelevant. Only the relative changes in the field are significant. The goal of most physics these days is to describe symmetries of nature that are both gauge symmetries and that demonstrate that field changes can be compensated for by the introduction of other fields, i.e. they demonstrate local symmetry.

A small, but important, additional consideration concerns the sequence of the transformations involved in any quantum system. If the sequence doesn't matter the transformations are called Abelian, which is another way of saying they are commutative. If the sequence matters, that is they are non-commutative, they are referred to as non-Abelian. Currently, all the fundamental theories of quantum physics are governed by non-Abelian local gauge theories, with the non-Abelian property lending itself to the ability of a field to interact with itself. A non-Abelian field responds dynamically to its own presence, as we have discovered already with gravity at the Planck scale.

The concept of symmetry has been used most successfully to describe the sequential diversification of the laws of nature from a single unified source. The initial unified symmetries of nature are 'broken' in sequence giving rise to the many particles and forces we observe in the universe. This process of symmetry breaking is understood to occur spontaneously as the universe cooled from the time of the 'Big Bang' or as one progresses to larger time and distance scales. At lower energy levels the laws of Nature get locked into asymmetrical orientations that are less comprehensive in their scope.

Mutual Exchange vs. Force

The classical concept of force, the application of some energy to overcome an amount of inertia, is no longer a useful one in modern physics. As we have seen, the restoration of local symmetry involves the addition of another field. The result of this interaction of two fields can be summarized by saying that they exchange a third entity, the quantum of the field. This exchange of a field quantum is what was previously understood as a force. In the local symmetry example above, involving a change in the electron and magnetic fields, the quantum of the field quantum is the photon.

These field quanta do not exist usually for very long, in fact they are often referred to as 'virtual' particles. Once emitted they must be reabsorbed by the same or another particle within a finite period of time in order to comply with the law of conservation of energy. We know them only

by their real world force effects. They also display a peculiar affinity for accounting in that the larger their energy (mass) the briefer their existence much like an embezzler who borrows from the bank knowing that the larger the sum the sooner it will be noticed so the sooner it must be repaid. The briefer the time also implies the shorter the distance.

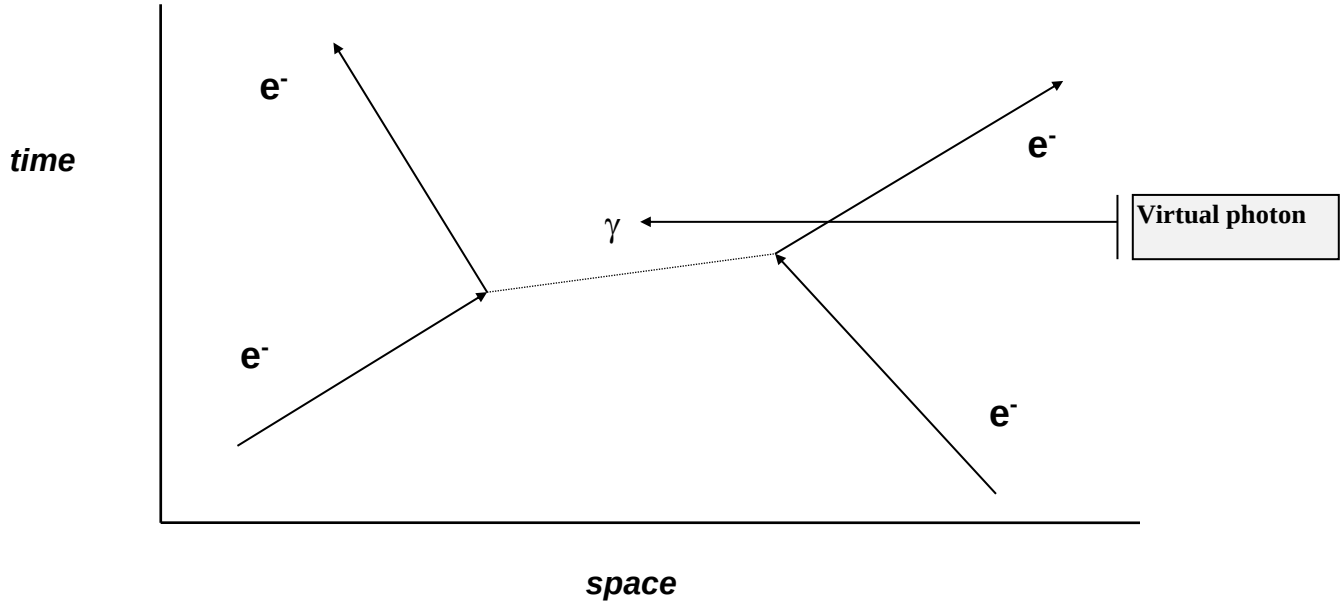


Fig. 7 - Space-time diagram of virtual interaction

Feynman's space-time diagrams describe how a particle such as a photon can also act in the role of a force in the scattering of electrons. Rather than speaking about a repulsive electron force, one need only consider that the electrons approach each other in space, one electron emits a photon changing its velocity and the other electron absorbs the photon changing its velocity. The theory that describes this process is the theory of quantum electrodynamics.

Interestingly enough, the roles of the electron field as particle and the electromagnetic field as force could easily be reversed. This gives rise to experiences that are not predicted in a classical context, such as the scattering of light by light. This consequence is not normally observed because of the high energies required for the electron to play the part of a force (remember the higher the energy, the briefer its existence). However, on the small time and distance scales of quantum reality, the scattering of light by light is absolutely acceptable. Thus any lingering distinction between particles and forces is really just historical anachronism, and the reality depends only on whether the field in question is in its 'particle' state or a virtual state.

For some time physics has identified four fundamental forces:

- ***electromagnetic force*** responsible for electricity, magnetism, and chemical reactions
- ***weak force*** responsible for radioactive decay
- ***strong force*** responsible for maintaining the atomic nucleus
- ***gravitational force*** responsible for space-time and the attraction between masses

Recent progress in theoretical physics has begun to unify these four forces along with their associated particle fields. The first two have been unified under the ***electro-weak theory*** which demonstrated that electromagnetism and the weak force were ultimately the same force acting under different conditions. The first three have been unified under various versions of ***grand unified theory*** (GUT's) and gravity has been incorporated into completely ***unified field theories***, such as superstring theory. While electro-weak theory has been verified by particle observations in high energy physics labs, the particle energies involved to directly verify GUT's or string theory are so large that they not available in our solar system. These theories describe force fields involving very massive particles, a billion, billion times as heavy as a proton mass. This doesn't mean they don't exist, only that they exist for very brief periods of time or during the intense energy conditions of the primordial universe. While specific versions will continue to be debated in the physics community, the broad strokes of any acceptable theory are clear -- quantum fields, uncertainty, and the breaking and restoration of local gauge symmetry.

Virtual Reality

Virtual particles can be created because of the quantum principle of uncertainty. If the time and distance scales involved in an event are small then there is a large uncertainty of energy which can temporarily create a new particle. As it turns out, these virtual particles do not just come into existence only when it is time for them to play their role of force intermediary but they are continually popping in and out of existence. Particles can be represented as centres of continuous activity surrounded by clouds of virtual particles that are being constantly emitted and absorbed.

Just to review, we began by describing the units of physics, particles, and then discovered that these units were seen as essentially abstract waves of probability. Then we said that these waves were excited states of some underlying field of information. The stable wave states of a field we called 'particles' and the exchange of transitory states of the field we called 'forces'. The properties of a particle are now seen as the sum of its stable wave state together with this cloud of ephemeral virtual wave states. A 'particle' is really just an occurrence which interconnects with other events in a particular way. In the words of the ancient Taoist philosophy, "*[the natural] laws are not forces external to things but represent the harmony of movement immanent in them*" -- I Ching (in Capra, 1979: 233).

What happens when we remove all these 'particles' from the system of observation? Presumably you end up with a field which is empty of 'particles' -- a vacuum. However, as it turns out, a quantum vacuum is far empty. Below, Fig. 8, is a space-time diagram of a possible vacuum

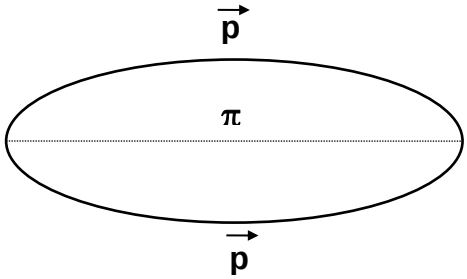


Fig. 8 - Sample vacuum fluctuation

fluctuation depicting the creation of a proton, anti-proton, and pi meson and their subsequent annihilation. While none of these events exist for long, they nevertheless contribute to the dynamism and energy of the vacuum. The vacuum itself is therefore fluctuating with every manner of quantum mechanical field state. Physicists describe it as a superposition of all possible field shapes (Fig. 9). This implies that the background of things and events is not a flat canvas as Newton assumed, but is inherently dynamic and is, in fact, a participant in many observed physical phenomena (for example lasers).

A more appropriate term than vacuum might be fullness. It contains every possible state of the field but, as a consequence of destructive interference, appears to be empty in the classical sense.

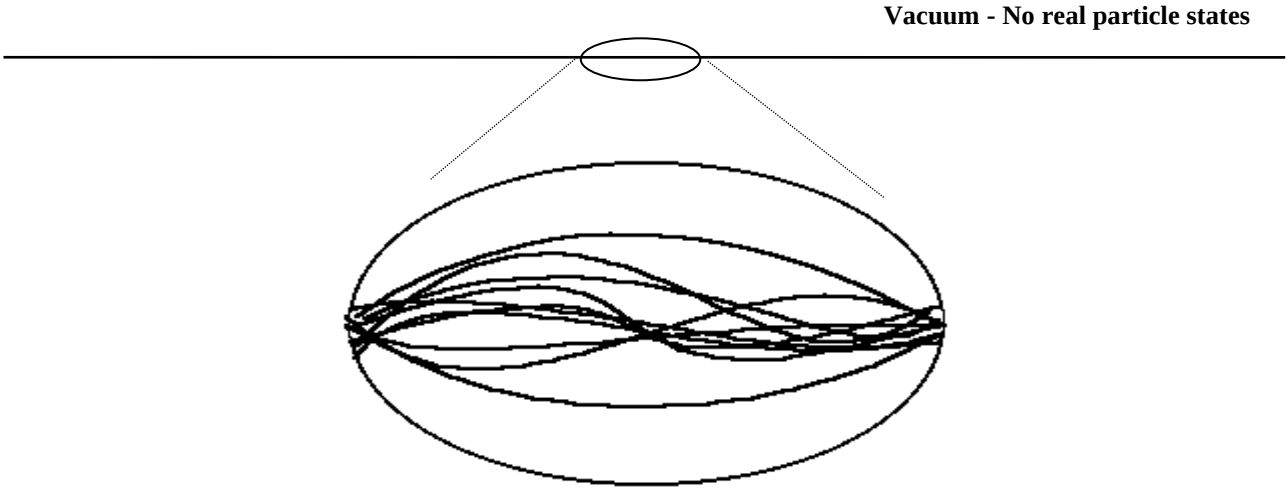
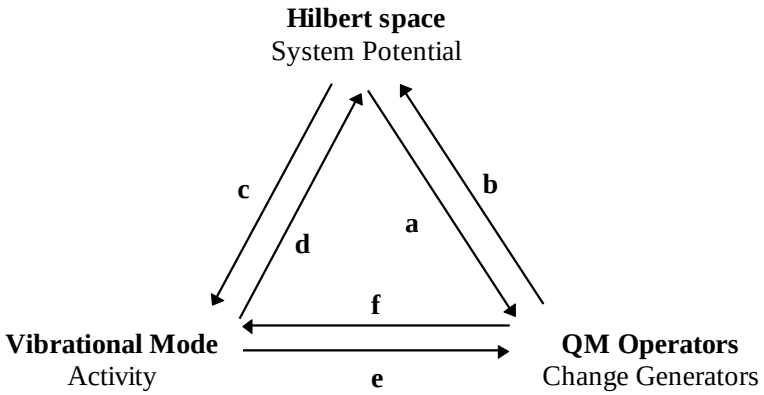


Fig. 9 - Dynamic Vacuum Fluctuations of the Vacuum

Quantum Knowledge Framework

Formally, quantum physics differs from other approaches in physics in that it treats the state of a system as a vector in linear space -- that is, as a single point representation in an infinite space of points representing all possible states of the system. The history or evolution of a quantum mechanical (QM) system corresponds to a motion within this space of states, called a Hilbert space. The fact that vectors can be additive in this Hilbert space leads to the principle of superposition which we discussed earlier with respect to the vacuum -- a specific state can be an additive sum of a number of different states. The Hilbert space is the abstract arena in which quantum mechanical events take place but the Hilbert space itself remains unchanged by these transformations. By acting as a referencing point, the space determines all the physical characteristics of the quantum system. It is like the observer for all quantum mechanical events. Any QM state vector can be decomposed into a meaningful set of basis vectors which provide all the properties of the quantum system -- energy, momentum, etc. The structure of the Hilbert space is such that one can freely choose among a variety of sets of basis vectors, each providing a different characterization of QM knowledge (Hagelin, 1989). This lends itself to the characteristically quantum property of having several distinct but complementary viewpoints from a single system under investigation.

The process of extracting information from a quantum system is provided by QM observables, such as the momentum operator or the Hamiltonian, which represent all the properties of the system that can be known. In Hilbert space these observables are operators, in contrast to the classical quantities they may represent, and act as dynamical generators of change, transforming one QM state into another and more generally, mapping the entire Hilbert space onto itself relating points to one another. This process of self-mapping is how the space becomes defined in terms of its symmetries and structure. The self-mapping defines the networks of information, the relationships characteristic of the Hilbert space.



a - Hilbert space presents all possible system states
b - QM operators define specific symmetries & structure
c - Localized mode is imbedded in network of all possible relationships
d - The vibrational mode is defined by reference to the whole
e - Activity is regulated under change generator
f - QM operators direct the time evolution of the system

Fig. 10 - Framework of Quantum Mechanical Knowledge

Lastly, the objects of QM knowledge are the quantum mechanical states themselves -- the localized points in Hilbert space representing isolated possibilities among a field of all possibilities. Each point represents the actual state of the physical system at any given moment. Defining these points requires a viewpoint, a choice of basis vectors, the most natural being the energy eigenvectors of the Hamiltonian which correspond to the stable vibrational modes of the system. They therefore define the activity or oscillations of the underlying fields which manifest themselves in macroscopic phenomena by weaving layer upon layer of vibrating fields. The choice of basis vector determines which network connects the system to the whole and how the whole is incorporated into the system. In a unified field description, this implies a level of infinite correlation.

It should be noted that, again in the context of unified quantum field theories, the apexes of the above framework are not isolated elements, but rather perspectives adopted by the same unified field.

Human / Quantum Connections?

The search for a truly unified field theory presupposes we are free to roam the universe and draw any logical conclusions we see. This view is consistent with the assumption that the observer and observation are separate entities. But if the unified field exists, we are part of it, and presumably it will be exerting some influence on us as we make our observations and determine our conclusions. In the case of a unified field, the assumption of observer / observed

separateness can no longer be entertained by very definition. We end up with a typically non-linear quantum event where we influence the theories of the laws of Nature and the laws of Nature influence us.

Almost since its inception quantum physics has caused many prominent physicists -- Eddington, Bohm, Schroedinger, Heisenburg, Wigner, Wheeler, and most recently Hagelin -- to suggest that the separation between observer and observation was at best artificial. The principle of uncertainty created a still as yet unresolved question of how the process of quantum measurement collapses the wave function under study by the physicist into a classically definable event. Wigner's conclusion was that this collapse occurred as result of the system's contact with some screening element of human consciousness (see below).

What is useful from this is the suggestion that if human observers can influence quantum events then there must be some commonality between external physical reality and human experience for some influence to be possible. The situation is analogous to a magnet and an electric current. If a magnet can influence an electric current , it presupposes a connection between the two which we know to be an electromagnetic field. Can there be a field underlying both physical and subjective realities? By definition, that is supposed to be what an unified field represents in physics, unless you admit to a somewhat less than unified field.

A connection between quantum realities and human experience does not sit well in the classical sense. In addition, it is certainly not obvious from the perspective that our descriptions of the laws of nature tend themselves to be creations of the human mind. They are, according to Capra "properties of our conceptual map of reality rather than the reality itself." (Capra, 1979: 303).

Wigner agrees describing them as "concepts of convenience" for the communication of ideas to others. In the words of Heisenburg, 'What we observe is not nature itself, but nature exposed to our method of questioning.'

Yet, if the laws of Nature are simply human constructs, then it is all the more striking that the external world does indeed conform to these "concepts of convenience". As an example, take the unusual effectiveness of mathematics in describing the world.

Wigner's Quantum Measurement

"The interaction between the measuring apparatus and the system in which the measurement should take place (the object of measurement) results in a state in which there is a strong statistical corelation between the state of the apparatus and the state of the object. In general, neither apparatus nor object is in a state which has a classical description. However, the state of the united system, apparatus plus object, is after the interaction such that only one state of the object is compatible with any given state of the apparatus ... Hence, it follows that the measurement of the state of the object has been reduced to the measurement of the state of the apparatus." However, the apparatus does not have a classical description, the measurement of the apparatus has not changed. The measurement is completed when it enters our consciousness. "A corelation is established there between the last state of the apparatus and something which affects consciousness." Wigner (in Capra, 1979:187*)*

Why is it that mathematics, a science of purely mental constructs, is seen to so readily describe the nature of external realities, not only in physics but in other disciplines as well? Reinmann geometry was created long before Einstein used it in his theory of general relativity. The system of complex numbers (that number system involving square roots of negative numbers), once believed to be just the imaginings of mathematicians, are now the cornerstone of quantum mechanics and quantum field theory. There is no obvious reason that this should be so.

It can only be that in some sense the laws of nature governing mental phenomena are the same, or at least exactly mirror, the laws of nature outside of us such that it enables us to gain knowledge of the world just by thinking about it. When we recall what we have learned of physical reality, and that it has been reduced to ordered relations of information flows, that ordering of information can go on equally well inside or outside of us as observers. If this is so, then we are once again led to the conclusion that at some deep level, our subjective experience must share the same quantum properties we observe in Nature.

Macroscopic Quantum Phenomena

Since quantum phenomena typically exist at time and distance scales that are not part of our everyday experience, their contributions to everyday events can often be ignored in favour of more classical descriptions of the laws of Nature. However, there do exist events where quantum laws are observed at macroscopic levels directing what can be referred to as a "social organizations of physical phenomena". They result from a lessening of kinetic entropy which tends to hide the quantum effects behind a veil of thermal activity and from the coherent superposition of a large number of quantum states. The most important of these macroscopic quantum phenomena are superfluidity, superconductivity, and super radiance.

Superfluidity

Superfluidity is a state of matter characterized by the complete absence of viscosity, or resistance to flow. When liquid helium is cooled below a critical temperature, 2.17 K (-270.98° C, or -455.76° F), it experiences a change of state (to helium II) associated with a variety of new behaviours resulting from underlying quantum properties coming to the surface. The principal effect of this change is to allow thermal conduction by radiation rather than by kinetic transfer. Helium II flows with no difficulty through extremely small holes, which ordinary liquid helium above that temperature cannot do. Researchers have also noticed that on the walls of its container, superfluid helium forms a thin film (approximately 100 atoms thick) that tends to flow up against gravity over the rim of the container. Its thermal conductivity is high, some 3 million times higher than that of helium I. Superfluid helium (helium II) spontaneously flows from a cool region to a region of higher temperature; helium I however, flows in the opposite direction. When a flow of superfluid helium is induced, moreover, temperature differences appear spontaneously in the liquid.

Helium II is believed to consist of a mixture of superfluid atoms and normal atoms. The superfluid atoms are atoms in their quantum ground state, or lowest energy state. The proportion of superfluid atoms increases when the temperature approaches absolute zero. The superfluid atoms carry no thermal energy, no entropy and behave as a group quantum mechanically. When

the proportion of the superfluid group becomes large enough, it induces a phase transition that projects the quantum properties on the entire sample.

Superconductivity

The theory superconductivity describes a quantum phenomenon, in which the electrons conducting electrical current dynamically pair up creating a superposition of their wave functions and allowing a transference of energy via the electromagnetic field rather than by the motion of individual electrons. It results in zero electrical resistance and is caused by lowering the temperature of the electrical system to near absolute zero. In such a condition the random kinetic disturbances associated with temperature are reduced to a point where the underlying quantum properties become dominant. With the absence of electrical resistance, a superconducting current can be maintained indefinitely, without loss of energy. In 1962 the British physicist Brian D. Josephson examined the quantum nature of superconductivity and proposed that if an electric current was present in two superconductors separated by a gap of thin insulating material, the quantum current would 'tunnel' through the barrier. The effect, known as the Josephson effect, was subsequently confirmed by experiments.

An important property of superconducting materials is their ability to expel any magnetic field from inside. Known as the 'Meisner Effect', electron pairs in the superconducting sample spontaneously organize their activity in such a way as to exactly counteract any applied outside magnetic field which could potentially introduce an element of disorder in the sample.

Super Radiance

Super radiance, commonly seen in laser light, occurs at any temperature and results from the constructive interference of a multitude of light photons being emitted from a coherent source. Ordinarily light sources, like a light bulb, are incoherent producing light of various colours (frequencies), and phases. Coherent means that the light source produces light of a single colour and phase and as a consequence the amplitudes of each photon become additive, resulting in constructive interference and macroscopic quantum light phenomena (laser light). Laser light's directional purity, and power are directly attributable to the magnification of a photon's quantum properties to everyday scales.

Self-Organizing Dissipative Structures

So far, our discussion has centred upon the *nature* of quantum reality -- what it is. What we found was that it is abstract, informational, infinitely correlated, uncertain, dynamically fluctuating, self-referencing, non-localizable, integrating, self-organizing, symmetrical and the source of all possibilities. To find out how it *acts* in the world, we need to include a discussion of thermodynamics, particularly the type of non-linear thermodynamics characteristic of dissipative structures and living systems.

Thermodynamics began as a study of heat but has evolved into a study of order, or more precisely the study of disorder called *entropy*. The second law of thermodynamics states that the

entropy of an isolated system can only increase or stay constant. A system reaches its maximum level of entropy when it equals that of its environment and is said to be in 'equilibrium'. When temperature, or kinetic activity, is minimal entropy is also minimal according to the third law.

Thermodynamics can be applied to processes as well as static structures. Dissipative structures are open systems that import free energy from the environment (Ilya Prigogine, the authority on non-equilibrium thermodynamics, refers to this as "eating order from the environment") and export entropy. For a dissipative structure to maintain itself, the production of internal entropy has to be greater than the level in the environment and so in an exchange with the environment, the non-equilibrium structure continuously renews itself. "*At all levels, be it the level of macroscopic physics, the level of fluctuations, or the microscopic level, non-equilibrium is the source of order. Non-equilibrium brings order out of chaos*" (Prigogine, 1984: 287).

Non-equilibrium structures involve sub-processes which when combined create a temporary state of stability representing a minimum energy state. Fluctuations among sub-processes which occur near equilibrium are dampened because they produce excess energy. Fluctuations far from equilibrium, however, may produce a new state of temporary stability if it represents a lower energy state. Conditions for this order through fluctuation are that the system be in open exchange with the environment, that they be far from equilibrium, and that they contain autocatalytic mechanisms, one's which are self-generative. Dissipative structures become '*autopoietic structures*' when their primary function becomes self-referential, that is, they are geared towards self-renewal. The autonomy of these [autopoietic] structures stems from "*the fundamental interdependence of structure and function which is one of the most profound laws of dissipative self-organization*" (Jantsch, 1980: 40). Structure spontaneously emerges from systemic function and the transfer of information from the environment.

"*The same conditions which lead to autopoiesis -- openness, non-equilibrium, and especially autocatalysis -- also underlie the possibility of internal self-amplification of fluctuations and their ultimate breakthrough {into a new state of order}. Without such internal self-amplification there is no true self-organization. The possible consequence is the evolution of the system through an indefinite sequence of instabilities each of which leads to the spontaneous formation of a new autopoietic structure*" (Jantsch, 1980:44).

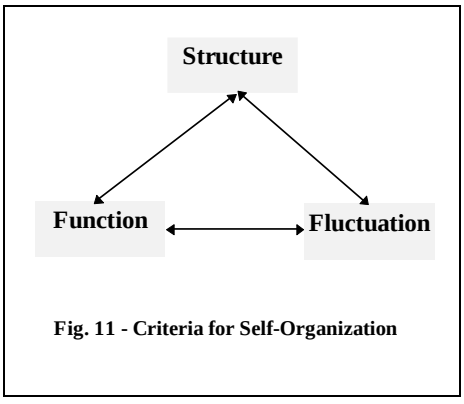


Fig. 11 - Criteria for Self-Organization

Self-organization is the result of a three-fold process involving structure, function, and fluctuation, which together can be thought of a one giant fluctuation. Both chance and necessity move the system to a higher level of organization -- chance through the contributions of individual fluctuations and necessity arising from the coupling of sub-processes. Since sub-processes combine to dampen 'innovation', the point where those fluctuations overcome these barriers, instability is the greatest and the need for a new stable structure is significant. During transitions, entropy production increases markedly, as the system spares no expense to move to the more stable, lower energy state.

We see here again the principle of complementarity which has characterized much of our previous discussions of the quantum world. "*It is not adaptation [learning to dominate] to a given environment that signals a unified overall evolution, but the co-evolution of system and environment at all levels, the co-evolution of micro- and macrocosmos*" (Jantsch, 1980:75).

While the path of evolution may not be predicted, each non-linear structure retains a 'memory' of the initial conditions which made its development possible. Autopoietic regimes are self-referential with respect to space-time structure, and therefore "*with respect to themselves as dynamic systems with the potential of manifesting themselves in a variety of structures, not in a random order, but in a coherent, evolutionary sequence*" (Jantsch, 1980:50).

The process of self-organization occurring in non-equilibrium thermodynamic structures is readily transferable to descriptions of quantum events involving vacuum fluctuations, and also cosmology, chemistry, biology, and many sociological phenomena. This broad applicability suggests a fundamental homology of self-organization on many levels.

"*Discoveries of science*", remarks Prigogine, "*... are often the result of negative discoveries, which provide the occasion and the starting point for a reversal of point of view.*

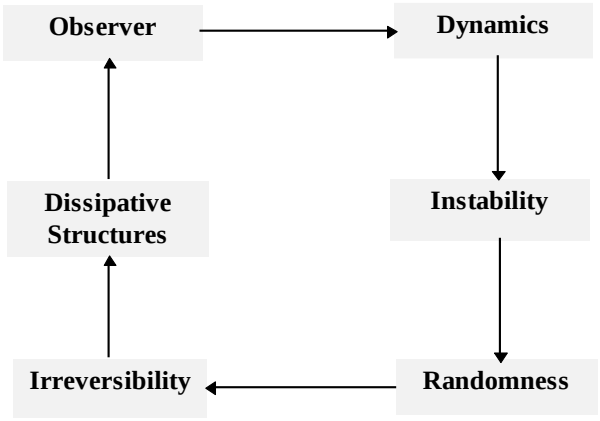


Fig.12 - Thermodynamic Paradigm of Evolution

Demonstrations of impossibility, whether in relativity, quantum mechanics, or thermodynamics, have shown us that 'nature' can not be described 'from the outside', as if by a spectator. Description is dialogue, communication, and this communication is subject to constraints that demonstrate that we are macroscopic beings embedded in the physical world" (Prigogine, 1984: 300). He presents the following framework for growth and the development of knowledge.

Summary of the Quantum Paradigm

- events and things are excitations of the underlying quantum fields in which they are imbedded. They can not be defined separately from the network of relationships they represent;

- external observables, the process of observation, and observers are all important as each influences and so determines the other;
- everything can be broken down into abstract fields of information which are infinite in extent and are known by laws which statistical in nature, giving results which can only be approximate if not grasped in their entirety;
- space and time are not absolute but can vary from place to place;
- the arena of quantum events is an abstract entity called Hilbert space representing all possible system states and all possible view points. It remains unchanged under any system transformation. This space is defined by the self-mapping of QM operators which also govern the change of any QM system;
- the diversified laws of Nature result from a movement to larger time and distances scales resulting in the spontaneous sequential breaking of symmetries found at more fundamental levels. Basically, Nature is unified;
- force is the result of an exchange of virtual field quantum in order to maintain the field's local gauge symmetries;
- uncertainty is the rule if one tries to define more than one quantity at a time;
- at smaller time and distance scales there is greater dynamism and greater correlation with the environment;
- the world is as we help define it to be. It does not conform to our everyday experience except as an approximation. The world is contradictory. It is, it isn't. It represents a coexistence of opposite logics that have their foundation in an area beyond logic and causality;
- man is the same stuff as the environment, implying the presence of quantum human properties that may be deeply hidden, though not inaccessible.

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SECTION 2 – A QUANTUM PARADIGM OF PUBLIC POLICY

Need for a New Paradigm in Public Policy

In the first section, it is hoped that the reader was challenged by some of the strange realities presented by quantum physics. As the physicist Niels Bohr once remarked "if someone is not shocked by quantum theory, then they haven't really understood it." Yet despite this strangeness one can not but hear the echo of issues predominating discussions of BGS relations today -- relationship defined reality; networks; uncertainty; the linking of subjectivity, process and outcomes; the increasing dynamism of smaller scales; and the coexistence of opposite logics. Given that 'reality' is that way, that is to say the universe is fundamentally quantum mechanical, then maybe the identification of these properties in social organization is not as strange as some might believe.

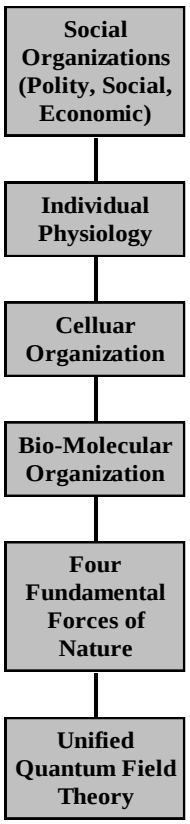

Fig. 13 - Foundations of Social Organization

It is easy to see, as in **Figure 13,** that the foundations of social organization can be traced back to a level governed by quantum theories. Is there reason, however, to suspect that these quantum foundations have significant relevance to areas of public policy? If so, are we using the appropriate knowledge framework to understand them -- quantum or classical?

I believe that there is a growing body of theoretical and empirical evidence that suggests that the classical paradigm is no longer sufficient to describe events in the sphere of BGS relations and that we do indeed live in a quantum world, even at the macro level. The subsequent discussions are intended to bring out the utility of a quantum perspective with regard to BGS, and to provide a metaphor for better understanding the complexity of issues confronting students of public policy.

The Newtonian world outlook is so powerful in its ability to organize and comprehend the natural world, it continues to be the chief human paradigm even to this day. The success of Newton's physics in predicting events in the physical the late 17th and early 18th century led philosophers like Locke, and other early students of human and social sciences to emulate his scientific approach. When 18th century constitutional framers tried to sketch out bold new relationships between individuals and the state, it was this world view that was incorporated via the scholars of the day. In **Figure 14** below, we can see the impact Newtonian philosophy has had on the social attitudes and structures of governance.

Classical Basis of Liberal Democracy

Classical Paradigm	Human Corollary	Public Policy Ramifications
Reality is separate, fragmentable, and atomistic	Humans are separate, self-contained autonomous units. The environment has no intrinsic claims to respect or consider.	Emphasis on the principle of individualism. Minimization of 'community' and maximization of **mutual exclusivity**.
Certainty is possible, reality is predictable	The behaviour of every human being is pre-set and controlled, governed by the same laws, i.e. no one operates from an alternative set of behaviours. Each person is thus interchangeable and there are no unique persons. Future events are predictable.	Given expectations, policy is the optimization of rational alternatives. Emphasis here is on **equality and conformity**. For example, since everyone is struggling for self-satisfaction, one can assume fair and equal competition because everyone seeks the same outcome. Optimal distribution of resources thus requires a policy of free market access under given environmental constraints.
Context free general-izations are possible	Due to mutual exclusivity and environmental independence, the primary mode of human behaviour is conflict. Behaviour becomes mainly the act of defending one's space or interests against another.	Social interests, defined as the aggregate of individual interests, are the collection of **powers to defend and control** possessions. Freedom is a function of possession.
Independence of knower and known	Creation of the notion of 'objective knowledge' as the reliable source of wisdom. Objective knowledge is value-free.	The principle of **representative democracy** - social governance is delegated to virtuous, know-ledgeable people to work on behalf of those lacking in 'objective knowledge'. Public policy based on objective knowledge is free of vested interests.
Absolute space & time	Human behaviour takes place against a fixed geographical, cultural and temporal background. Conformity of behaviour across space and time. Adaptive periods are long.	De-emphasis on regional and local concerns in favour of centralisation. Long adaptive periods favour **mechanistic bureaucracy** to improve efficiency, and enhance power and control.
Existence of linear causality	Human beings are unitary wholes, unfrag-mented and motivated by precise, rational, and predictable desires. Principal among these is the motivation to act in one's own self-interest.	**BGS relations are additive**, resulting from the actions of separate parts on one another. For example, the promotion of competition among a nation's self-interested citizenry produces a compromise that benefits everyone.
Force is energy applied to overcome or resist change	The differences of attainment between those that have and those that have not, produce equalization forces. These forces act in both directions - for and against change.	The perfection of public policy requires the perfect adjustment of all the forces among its constituent elements. The continual adjustment of social forces is the basis of **interventionist government.** The goal

Classical Paradigm	Human Corollary	Public Policy Ramifications
		of this intervention is stability, often inter-preted as non-change.
Man can shape the environment	As a separate entity, the environment has value only according to its usefulness and is modifiable to enhance that utility, using predictable, objective knowledge. The environment does not posses any intrinsic value.	Public organizations have a responsibility for the **minimization of scarcity** and the preservation of natural resources in order to prolong the usefulness of the environment for future individual interests. **Environmental value equals market value** of the environment.

* Adapted from C.D. Slaton, Quantum Theory and Political Theory, in *Quantum Politics*, T.L. Becker, ed., Praeger Publishers, New York, NY, 1991: 41-63

The problem with this classical approach, is not so much its inaccuracy, but its incompleteness. Just as Newtonian physics eventually proved to be inadequate in describing the complete picture of the physical sciences, the application of the classical paradigm to governance and public policy issues is proving to be insufficient. Barber states that the fatal flaw of applying classical physics to politics is the major axiom of liberal democracies that "*humans are material beings... and are governed by the laws of classical mechanics*." This axiom leads liberalism to "*resist systems that have activity, uncertainty, spontaneity, complexity, ambiguity, and process as major components*". Critics of this axiom are labelled non-scientific and irrational. All the while its "*pretensions to objectivity and philosophical certainty... have proved inimical to practical reason and to participatory political activity*" (Barber, 1984:29).

Although the classical paradigm is strongly entrenched, cracks are appearing in its hold on some of those concerned with political and social thought. Among them Becker points to its "*superficiality and inconsistency*", its "*narrowness and rigidity*", and its "*obsolescence*". Rudolph Rummel has worked for over a generation attempting to place complex social phenomena in the context of a theory of social fields. He sees his work as "*manifesting a shift from a Newtonian approach to man scientifically and quantitatively to a quantum theory perspective; from an emphasis on known variables and determinate observations and functions to unknown variables and indeterminate observations and functions; from an emphasis on absolute characteristics and fully specified functional relations to a view of the whole, the interrelatedness of men, groups, and characteristics; from a focus on a few well chosen variables to the system of relations between hundreds of variables; from the emphasis on curve-fitting functions to the space of functions, or the function of functions; and from a focus on fixed data and entities to probability density functions*" (Rummel, 1977: 483).

A Quantum Model of Public Policy

Wholeness

An alternative to the liberal democratic axiom and just as plausible, in light of quantum physics, is that humans are spiritual beings, excitations of some underlying wholeness, governed by quantum rules but in the approximation adhering to classical laws. This is the view, as Capra

points out in the *Tao of Physics*, essentially held by more than half the world's population and is expressed in the philosophical traditions of Confucianism, Buddhism and Hinduism. Each human being is defined by and is an integral part of the universe.

The exaltation of individuality and autonomy has had serious repercussions on our sense of community and social obligation. Schuman connects the growing sense of alienation in Western democracies with liberal individualism (Schuman, 1986) and Michael points out that while "*our values still emphasize individual rights and autonomy, ... the actual circumstances of life make imperative the acceptance of obligation and interdependence*" (in Paquet & Roy, 1996: 188). Overman puts it more bluntly, "*Exclusivity is simply not a viable logic in contemporary public policy and the modern democratic state*" (Overman, 1991:155).

Slaton sees that instead of mutual exclusivity, we can share the same space with others without surrendering our uniqueness, our freedoms or our values (Slaton, 1991: 48). Our uniqueness thus becomes defined by our relationships and interconnections rather than the degree of our isolation; our freedom the result of the expansion of our territory of influence due to the networks we participate in; and our values arrived at through the sharing of ideas, feelings and experiences with others. As Kevin Kelly remarks, "*Life is a networked thing -- a distributed being. It is one organism extended in space and time. There is no individual life. Nowhere do we find a solo organism living. Life is always plural...Life entails interconnections, links and shared multiples*" (Kelly, 1994: 102).

Uncertainty

"*It seems to me that this failure of the economists to guide policy more successfully is closely connected with their propensity to imitate as closely as possible the procedures of the brilliantly successful [classical] physical sciences... I confess that I prefer true but imperfect knowledge, even if it leaves much undetermined and unpredictable, to a pretence of exact knowledge that is likely to be false*" (Hayek, 1989: 3-5).

The assumptions of rationality and predictability of liberal democracy are not valid for describing human behaviour. Humans are not indivisible wholes. They are contradictory and diversified. Individual desires, intentions and talents are unequal. "*It is very likely that [human] intelligence, at bottom, is a probabilistic or statistical phenomenon*" (Kelly, 1994: 44).

Behaviour is not just the result of rational choice to fulfill one's own best interest. Behaviour is a response based on who we are, in fact, who we are at the moment. Who we are is a unique collection of experiences, feelings and ideas -- some rational and some irrational. It is also a result of our physiologic state -- whether we are tired or fresh, sick or healthy, old or young. Effective behaviour is more likely to be based on experiences of mutual exchange or co-operation, as Paquet & Roy point out in their discussion of the prisoner's dilemma (158). The rational approach, as a basis for decision making in social organizations, "*will inevitably come up short*" (Slaton, 1991: 50) for it ignores all the emotional, intuitive and other non-rational inputs. Human behaviour has so much potential for conflicting purposes that the only thing one can be sure of is its **uncertainty**. The premise of determinism and rationality as a primary basis for all

human interactions is not only invalid, but as Dator states "*probability, randomness, uncertainty, and complementarity are normal*" (in Slaton, 1991:54).

Rationality in public policy may be useful in some situations but it can not always be assumed. To do so can lead to serious consequences. A fundamental example is the notion that free and open markets motivated by rational self-interest will always act in the best interest of society. Rather than rational, however, it would be more accurate to describe the market phenomenon as uncertainty masquerading as predictability. No one fully 'understands' the market given its extensive nature, the market serves no specific purpose that anyone can define in advance, and it produces results that are not immediately observable, that is, it produces a tangled web of cause and effect. Hayek points out that these properties of the market stand in direct contrast to Cartesian logic and the Newtonian paradigm (in Peters, 1992: 499).

diZerega illustrates the consequences of this failed rationality in the case of Exxon Corporation arguing, after the Valdez oil spill disaster in 1989, that their restoration costs should be limited to the market value of the ecology they destroyed. Since the market value of this wilderness area was minimal, Exxon felt justified in claiming only limited liability for the cleanup. In the context of global ecology, however, Exxon's 'rational' market claim proves totally irrational and inadequate (diZerega, 1994: 90).

Weiss discusses how economic development policy from 1950 - 1970 was characterized by 'rational economic policy' -- policy choices often made using mathematical optimization techniques. However, "*the problem was how to formulate 'optimal' strategies, policies, programs, and projects without having enough knowledge in advance on available opportunities and conceivable alternatives and their effects on the macro, sectoral, regional, and project levels*" (Weiss, 1992:371).

Rational policy approaches assume the ability to define a situation precisely and in context when in fact precise information is never known and problems are often attacked piecemeal and out of context. Simon has established the concept of '**bounded rationality**' maintaining that "a *limited span of attention, uncertainty of outcomes, lack of reliable knowledge and information, and the evocation of frames of reference establish the limits of human rationality*" (Overman, 1991). Nevertheless, governments have built huge bureaucracies to process information that was never complete and to produce results that were never fully understood. Paquet & Roy summarize the criticisms of the old, centralized governance system as:

- **government overload** - despite its size, government can not meet the needs of the citizenry,
- **lack of legitimacy** - the public doesn't believe the state has the moral or technical ability to deal with issues,
- **fiscal crisis** - the state cannot foster wealth creation to the same extent it absorbs and redistributes wealth, and
- **social limits to growth** - fundamental concerns out of the range of government influence are calling for social reorganization

"*The new [organizational] paradigm recognizes the unstable, even chaotic nature of the external environment ... organizations are based more on teamwork, clan control, face-to-face*

interactions, frequent innovations, and a learning approach. The qualities of equality, empowerment, horizontal relationships, and consensus building are particularly important" (Daft, 1995: 23). The impact of these changes on governance is witnessed in the growing trends towards decentralization, devolution, networked enterprises, and multistakeholder forms of governance. To adapt to high levels of uncertainty, organizations are having to develop "*a rough sense as to the general principles with which unforeseen contingencies will be met*" as well as a "*corporate culture [that] plays a role by establishing the general principles that should be applied*" (Kreps, 1990).

Today's goals of governance are to prepare the actors, set the stage, provide the props, and then be willing to accept whatever outcome evolves. The script will be a self-evolving interplay that can not be predicted.

"In contrast to a widely held belief, planning does not result in the reduction of uncertainty and complexity, but in their increase. Uncertainty increases because the spectrum of options is deliberately widened...Complexity increases because the immediate domain of the organization ... is transcended and relations within the larger system of society, culture or the world at large move into the foreground. Reality is complex, and evolution manifests in the increase of complexity. Greater complexity, therefore, means a more realistic attitude taken by planning." (Jantsch, 1980).

In the context of the indeterminable nature of current events and the unpredictable nature of future events and processes, 'rational' economic policy that focuses on optimum choices given expected situations is no longer tenable. "*Instead, the issue shifts to creating possibilities which allow [nations] to react rapidly and effectively to unpredictable events from a position of relative strength. In turbulent environments, it is a sensible strategy to create potential... potential in this sense is not only capital, but also, in a dynamic approach, management potential in the widest sense, levels of training and command of technological skills, R & D capacities, standing in international capital markets and political goodwill in the field of international co-operation.*" (Weiss, 1992:382). Weiss also identifies 10 further areas which can help develop this potential in the area of international development:

- removal of price distortions
- administrative efficiency
- strengthening of sensible market mechanisms
- realistic exchange rates & positive real interest rates
- reduction of administrative structure
- blending of domestic and foreign economic affairs
- eliminating strategic bottlenecks
- development of broadly based national consensus
- visible commitment by top leadership to priority of economic development
- recognition that adjustment is a permanent process (Weiss, 1992: 383)

Context Dependent

In the past, the key to social governance was control -- control of resources, control of people, control of markets -- to minimize uncertainty. Critical elements were identified and put under direct control, like the purchase of Conoco by Dupont in 1973 in response to the OPEC oil crisis, or Canada's National Energy Program created for the same reason. The policy of isolating to control assumes that these elements can be separated from their environmental context without impact. Melin indicates that this may not be the best approach -- "*there has been a tendency to isolate phenomena in reality in an artificial way and to study just a few of all the relevant aspects of a problem*" (Melin, 1987:24). Paquet & Roy also indicate that reductionism may not be the best approach, suggesting that the cross linkages between BGS sectors are so rich that one can not entertain the idea of dealing with any of the three independently.

"*The boundaries between the private, public and social sectors are not well-defined either conceptually or statistically, because they are not rigid frontiers but rather wavering and continually evolving zones of overlap, interaction, and interdependency*" (Paquet & Roy, 1996 pg 27) and then later "*The interactions and interdependencies of all actors in a modern socio-economy are so extensive that it seems inane to focus almost solely on only one"* (Paquet & Roy, 1996 pg 135).

In the past control and context independence may have made sense -- not any longer. Managing change, complexity and uncertainty are the key elements of current decision-making. Knowledge is now the major critical element of value added. Unfortunately, it is not as amenable to being tied down as an oil field or copper mine and tends to flow regardless of constraints, as, for example, information on the Tiananmen Square massacre streamed out of China despite the media blackout by the Chinese government.

Tom Peters has remarked that, "*organizational arrangements emerging in our highly interconnected, fast-paced, intangibles/knowledge-intense, relationship-driven global village seem far more consistent with 'quantum reality' than 'Newtonian reality.' Relationships. Networks. The intangibilizing ('informatting') of everything. 'Spiderweb' organizations. All these ideas are of a piece with the elusive (key word!) principles of quantum physics*" (Peters, 1994: 373). New technology, such as EDI, is creating relationships up, down and across the organizational landscape that are antithetical to control.

The growth of partnerships -- business/business, business/government, government/non-profit, and business/non-profit -- exemplify the recognition that single organizations may not have all the knowledge or resources to identify and effectively respond to every challenge, but that that risk can be diversified by working with others. "*There is now a recognition of the necessity of shared commitment and risk, as well as the need to define explicitly the mutual goals of the parties involved*" (Gratias & Boyd, 1995: 5). Innovation, adaptability, and co-operation, today's imperatives, are juxtaposed to control and contextual extraction.

"*We need a theory that better maps the wholeness and the ambiguity of the industrial reality,"* says Melin. *"We must place this theory within a context. This means that a theory about structural change in and between industrial organizations must have a distinctly industrial*

character and include the societal level of the industrial reality...We must, for example, combine seemingly objective explanations behind industrial change such as determinist, external causes with more subjective reasons such as voluntarist, human action-oriented causes." (Melin, 1987:25)

To Melin, and others like him, including Lewin, Rummel, and Mey, the relationship dense nature of human interaction precludes any dissected approach in understanding social phenomena. They have suggested, each in their own way, that a more appropriate model might be field theoretic. "*Social action has to be derived from a totality of existing facts. These coexisting facts have the character of a dynamic field in that the state of any part of this field depends more or less on every other part... The meaning of a single fact depends on its position in the field*" (Melin, 1987: 26). These field theoretic models have much more in common with a quantum approach than a classical one. As Arrow points out in his **Impossibility Theorem,** public policy must be context dependent by necessity, "*Optimum public policy and social welfare functions are **impossible** to construct from atomized individual preferences, and solutions to complex policy issues ultimately require compromise, trade-offs, or reconstruction simply because it is **impossible** to know singularly what to do*" (Arrow, 1963).

In offering an alternative to the classical context-free approach to policy making Slaton suggests that, "*Rather than designing institutions that encourage us to live in private or small group worlds, pursuing narrow self-interests, developing top-down hierarchies with one-way communication, ... quantum politics attempts to maximize participation, interaction and a recognition that we are all inalterably connected in the system. To lose touch of the whole, is to work against one's own self-interest*" (Slaton, 1991:55).

Interdependence of Observer, Process and Outcomes

It is becoming clear that there can be no clearly discernible 'objective' reality when describing specific BGS events, or more generally, in understanding the relationship between sectors. In both cases subjective contributions, either individually or collectively, modify 'reality'. "*Social reality ... is determined by the institutions and symbolic universes we create around ourselves*" (Berger & Luckman, 1967:186)

Observers do not just observe, but they also influence. For instance, Becker remarks on how media commentators do not merely present news (Becker, 1991: 13) -- they attempt to influence events as well. In a recent issue of *Maclean's* (Mar. 11, 1996: 9), as an example, commentator Charles Gordon takes issue with how the media not only presents the facts, but attempts to influence public opinion by what and how they report. He illustrates with the news 'event' of Prime Minister Chretien's pugilistic encounter in Hull which Gordon says,

"*politicians, media and rented experts on television -- all were busy making points that had nothing to do with what had actually happened. What actually happened, as is so often the case, became less important than the putative implications of what actually happened ... For those looking for implications, it made more sense for the tussle to be over unity, even if it wasn't ... Inevitably, the reaction to the story became a story in itself".*

By influencing the phenomenon they report, the media alter that phenomenon, the reporters are themselves altered by the changing phenomenon, and other reporters as well. The actual reality is a combination of 'bare' reality plus interpretative contributions, reminiscent of the physicist's description of electron reality - 'bare' mass surrounded by a cloud of 'virtual' particles.

According to Becker, governments do not represent a uniform and unitary ideology but rather a collection of a variety of ideologies held by the polity that are reinforced by those in control of the government apparatus. This collective consciousness slants perceptions, filters alternatives, and biases evaluation in favour of maintaining the prevailing structure. Disturbing facts are hidden, and the exposure of negative information is rationalized, confounded, and neutralized. In the example of the water glass analogy, the dominant ideology would say the glass is 50% full. Those not influenced by the official ideology, usually those not in power, would view the same facts and report that the glass is half empty. Becker postulates that there may indeed be "an objective political reality", but trying to pin it down to an exact description will often yield paradoxical or contradictory outcomes, depending on the perspective of the observer.

As an example of how a dominant ideology can reinforce the status quo, Overman points to David Stockman, Director of the Office of Management and Budgets in the Reagan era, who admitted that economic indicators, such as unemployment levels, in addition to deficits and revenues were altered to reflect Reagan's preferences for certain policies. This was done not with any malicious intent, but in the hope that Wall Street would react favourably to positive projections and act in such a way as to make the optimistic projections come true (Overman, 1991: 159).

"*Mental anticipation pulls the future into the present and reverses the direction of causality. Mind in this view is no longer the opposite of matter, but rather it is the quality of self-organization of the dynamic processes characterizing the system and its relationship with the environment. Mind co-ordinates the space-time structure of matter*" (Jantsch, 1980:14).

Just as Wigner suggested, reality seems to interact strongly with human consciousness, and this interaction occurs through perceptions, values, epistemologies and expressions. Events are not as important as how they are interpreted. There is a wonderful story I heard in India about a snake and a rope that illustrates this.

One morning an old farmer goes out to his barn after a somewhat restless night. Since the light is still dim and his eyes are not as sharp as they used to be, when he looks over in the corner of the barn at a pile of rope, and thinks he sees a great huge cobra. He actually sees is the coil of rope but in the dim light and grogginess of the morning he interprets this as a snake. Startled in fear, he turns and flees the barn yelling "Snake! Snake! Snake!" As he reaches the house, the shock of the so-called snake causes him to have a heart attack.

Now the whole family is aroused from their sleep. Some try to attend to grandpa who has collapsed on the step, while others grab guns and sticks to go after the giant snake. By the time they enter the barn, the daylight is a little stronger and so they take no notice of the rope coil as they search for the snake. When no snake is found, it is assumed the snake has escaped outside.

The police and neighbours are called in to help search for the snake that has almost killed grandpa. Obviously, no one wants a giant, poisonous cobra loose in the grass where all the children are playing. Just imagine then the scene of chaos with sirens wailing, children crying, and scared men running and yelling about with guns and sticks -- an accident ready to happen.

What is the cause of this commotion? -- a simple, inert pile of rope. Sounds ridiculous, but true. The problem is completely without foundation. Grandpa's heart attack is real. The fear in the neighbourhood is real. The police and the ambulances are real, but the problem of the snake is, however, completely unreal. It is perception -- rather mistaken perception -- coupled with an interpretation in consciousness that is really the cause. A subjective event has created a whole chain of 'objective' problems and occurrences that have no basis from a rational point of view.

This relationship between the environment, consciousness and action is similarly described by Lewin and his Berliner group who throw "*emphasis on the perceived environment as a unit of extended consciousness. For the most part men do not act in the world as it is but as they perceive it. It is in the subjective environment that all real possibilities for action are to be found*." (Mey, 1972: 34-35).

The appreciation of this connection between perception and reality has now become so strong that the symbolic manipulation of perceptions is now pretty much the approach to public policy. How often do we hear from business and government that "perception is reality"? "*The important lesson for the political scientist in quantum theory is that there is no objective real world apart from one's consciousness, or, as Dator states, 'different observer, different world'. Our observations are limited to our perceptions and consciousness*" (Slaton, 1991: 56).

The significance of this subjective contribution to BGS should not be trivialized, particularly in the area of leadership. More and more we find corporate and public sector leaders relinquishing their command-and-control roles in favour of decentralization and the pushing of decision-making to lower levels of their organizations. Rather than using reward power, they cultivate referent power by embedding in the broad strokes of organizational vision their own personal beliefs, expectations and desires. If reality can be defined by the perception or collective belief of a group, organization, or society and that reality is not satisfactory, then the easiest way to change it is to change their collective vision. "*While we understand our current situation to be a product of some giant participatory collusion, we may also realize that alternative realities are possible, and the first step is to create the alternative vision in which others may participate*" (Overman, 1991: 164). Consciousness is infinitely more flexible than organizational structures, and as we have seen in work dealing with corporate cultures, a change in collective consciousness will precipitate changes in structure.

Space & Time Impact Events

In the classical concept, both space and time are absolute. In our BGS context, that implies geography, culture and time do not participate in events but only provide a background upon which events take place. While this assumption may have held 100 or even 50 years ago, the presence of instantaneous, world-wide communications, the globalization of markets and trade,

and the rapid pace of change have made geography, culture and time critical determinants of any private or public development strategy.

> "*The templates of international economics -- which paid little attention to technology, geography, and organization, and which stylized a world of exchange between space-bound countries where the comparative advantage of the national blocs of relatively immobile inputs was derived in a mechanical and simplistic from resources endowments -- are not usable any longer*" (de la Mothe & Paquet, 1994: 101).

Whereas previous public strategies were formulated assuming a relative uniformity of language and culture, of national or regional markets, and of government jurisdictions, today's strategies must at the outset have a global perspective. Weiss specifically points out that 'rational economic policy' has not been successful because socio-cultural problems arose when behavioural norms, motivational patterns, and the nature of public sector decision processes were disregarded or ignored. Empirical evidence illustrates, on the other hand, that cultural factors having strong impact on value systems and behavioural patterns also had subsequently a positive impact on the success of international development programs. "*Effective development usually goes hand in hand with a growing complexity and differentiation of the domestic socio-economic and political web*" (Weiss, 1992:374). In addition, differences in language and culture are now increasingly elements of strategic consideration that eventually lead to the development of comparative advantage (see Paquet & Roy's discussion of Ente Regionale er la Valorizzazione Economica del Territorio, 1996:195).

Differences in geography can define comparative advantage in sources of supply, customers, financial markets, competition, and labour. Events involving any of these factors in one area can have a profound impact for other geographically separated regions. Most important among these are the highly mobile human and technology resources which are key to any modern development strategy. As an example, Naisbitt remarks that the population migration from the North and East to the South and West of the USA between 1970 and 1980 is primarily a reflection of the ability of those areas to respond effectively to changes in the global economy (Naisbitt, 1984:238). The need to respond to international factors is as true now for the small and medium sized firms as it is for the large multi-nationals. Governments, too, at all levels -- national, regional and local -- are competing internationally to attract firms and development dollars. In other terms, they are required to adjust to international economic, geographic, cultural and political pressures.

Firms must now consider the impact of regulation from international bodies, such as the WTO, the EU and NAFTA on business decisions, in addition to national and regional legislation. The internet is confusing things even more as firms legally operating in one jurisdiction are being held accountable for actions taken by others in an entirely different jurisdiction.

It is interesting to glance at the table of contents in Naisbitt's 1984 book *Megatrends* (below) to get an overview of the trends that have been shaping society. At the time of writing these were the emergent trends. Now twelve years later these are the realities. The pace of change is now so fast -- the amount of knowledge is doubling every 3 -5 years (Swanson & Oates, 1989:31) -- that the time frame of major social and economic transformations has shrunk to less than one

lifetime. As Christopher Hill points out (Hill, 1996), the fact that the adaptation cycle is now less than one lifetime puts strong pressure on individuals and social organizations to continually adjust. Time, which previously was considered as a kind of a non-interacting measuring rod of socio-economic events, is now a critical element of success. Long term stability is now a function of flexibility, often expressed as just-in-time supply and demand considerations or time-to-market strategic considerations.

The implication of the increasing importance of local and regional differences as sources of comparative advantage is demonstrated in the focus shift from national to meso and local levels where appreciation of these advantages are more acute and adaptive time frames are shorter. Centralized bureaucracy is giving way to decentralized networks that offer more responsiveness and flexibility. Hill suggests the need for new systems of co-ordination, investment in

Megatrends* 

Industrial Society.....Information Society

Forced Technology.....High Tech/High Touch

National Economy.....World Economy

Short Term .....Long term

Centralization.....Decentralization

Institutional Help.....Self - Help

Representative Democracy.....Participatory Democracy

Hierarchies.....Networks

North.....South

Either/Or.....Multiple

*from Naisbitt, John, *Megatrends*, Warner Books, New York, NY, 1984

knowledge capital, and greater attention to adjustment (Hill, 1996). "*Instead of detailed mechanistic attempts at regulation, the task is to strengthen the general problem-solving capacity of the actors by means of general regulations aiming at viability at large and allowing for evolutionary search processes and self-organization*" (Weiss, 1992: 383).

This development of problem solving capacity can be best described by what Paquet and Roy describe as **social learning.** Social learning is "*the process of interaction through which individuals and organizations learn from each other and consequently adapt, innovate, develop new arrangements, conventions and rules*" (Paquet & Roy, 1996: 29). Far from being a backdrop for events, relative differences in geography, culture and time impact social learning and as such are having a large impact on the flexibility, adaptability and progress of actors in society.

Non-Linearity & Opposite Logics

The world is contradictory. It is, and it isn't. Our everyday experience tells us this world of multiplicity exists, yet our understanding tells us the universe is as void as intergalactic space, permeated by unlocalized fields of energy and information. Physical 'reality' has a vacuum that contains all possibilities, and the most opposite of all values -- energy and matter -- are unified in a single concept. Human life is itself the antithesis of traditional scientific thought merging together as it does subjectivity and matter to such an extent that the boundary between them is not clearly discernible (Chopra, 1989). The world represents a balance of opposite logics that have at their foundation an area beyond logic or causality.

The acceleration of the rate and complexity of change presents a growing number of paradoxical challenges that demand acceptance over resolution, transcendence over discrimination. It is, for example, seemingly inconsistent that as the arena of markets, politics and social concerns has become more internationalized, the significance and power of the smaller players have grown -- Naisbitt's *global paradox.* Organizations too are becoming smaller, subcontracting more, focusing on those elements which add significant value to their customers, as in the experience of ABB, Asea Brown Boveri. At the same time, firms are developing global strategies and becoming global players by embedding themselves in 'big' networks. Or, a firm may decide to target a hyperniche, and come out a global player by becoming the world's best, that is, by developing large economies of scale relative to the niche.

From a traditional standpoint it does not make sense for competitors to work together, yet increasingly we find them doing so in order to improve both their environmental scanning and their response potential as well as creating opportunities for themselves. "*In the face of an environment permeated by fast technical change, firms must improve their 'absorptive capacity' (their capacity to learn from this environment). As a result they form R&D co-operative networks with other firms and strengthen thereby the innovative capacity*" (Paquet & Roy, 1996: 149). While competition develops excellence in a linear way through the development of uniformity and stability, co-operation minimizes the chance that you'll be blindsided by diverse and unpredictable events outside your field of influence. Hence there exists a need to be uniform and stable while simultaneously being flexible and innovative. "*The emerging [competitive trend] appears to be one in which strategy focuses less on how to react and more on how to influence the environment in which the company operates*" (Belohlav, 1996: 16).

Complex organizations that maintain rich interlacing dependencies are extremely vulnerable. The failure of any one of those dependent elements can cause the whole system to crash. Large,

complicated systems "*breakdown not only under the force of a mighty blow, but also at the drop of a pin. Large interactive systems perpetually organize themselves to a critical state in which a minor event starts a chain reaction that can lead to a catastrophe. [In the past it was] assumed that the response of a large interactive system was proportional to the disturbance*" (Bak & Chen, 1991: 46). The obvious solution is to be more self-sufficient and autonomous but this can lead to poor environmental scanning and missed opportunities. The optimal solution, therefore, is to maintain network dependencies and self-sufficiency at the same time.

The challenge of governance today can be described as the challenge of balancing a host of self-contradictory issues. Citizens want universally available healthcare, but they don't want the perceived expensive costs of public investment in healthcare. They want an unpolluted, pristine environment, without sacrificing jobs or development. They want to advance their economic aspirations -- often seen as a function of long, hard work -- but are increasingly unwilling to do so at the expense of their health or their families. They want a justice system that offers freedom from crime, but not a complicated legal system that seems fair only to legal practitioners. They want a faster rate of progress, but will not accept the continuing deterioration of education, family life, and the social dislocations that follow in its wake. They want to maintain national security and contribute to world peace, but not at the expense of Canadian lives. Policy responses have tended in the past to favour one side of an issue over another, or to fashion a compromise blend of the two. The maturation, education and sophistication of the electorate, however, have created a situation where Canadians don't want to make a choice of one option over another -- they want it all. For rational policy makers it is a nightmare, implying as it does that they will '*dammed if they do and dammed if they don't*'.

For example, there is a generally acknowledged problem of drug abuse. This is an event, so we ask ourselves what is its cause? If we believe this issue is supply related, then we will vigorously attack drug dealers and the international drug cartels. However, if we try reducing the supply of drugs without reducing demand, more suppliers come into the market because a fixed demand for a shrinking supply will make the reward more acceptable to some given the risks involved. If we try to eliminate demand, then we find ourselves mired in a host of other issues such as education, poverty, jobs, social welfare, healthcare, urbanization, racism, third sector participation, and so on.

The complexity and presence of multiple causes leads us to describe this 'wicked policy' issue as being non-local. Non-locality, here as in physics, means that seemingly independent events may be effecting one another. The non-local nature of BGS means that its relations are not additive and the complexity and the interdependencies of the BGS imply that actors respond not only to other actors but also to the overall BGS playing field. Its much like designing a house while the workmen are building it -- each individual contribution causes the design to change. The BGS field is thus responding dynamically to its own presence, again suggesting a non-commutative property.

Weiss comments that the national cultural framework is a means of integrating opposites tendencies. Not only does culture represent a set of shared values and beliefs, but it also acts as a mental map for interpreting and integrating novel experiences and ideas. In the successful East Asian NIC's, western rationalism is interwoven with Eastern traditions forming productive

polarities. The resultant new culture impacts both individual and social discipline, achievement and motivation, the ability to learn, co-operation for collective goals, and the ability to adjust to a dynamic international environment. "*The positive attitude towards such concepts is rooted in a cultural pattern of thinking in polarities -- rather than in mutually incompatible opposites as in the monotheistic Judaic-Christian-Islamic heritage -- and in the concept of an ever-changing Universe in which there are neither firm facts nor determined courses but only open processes*" (Weiss, 1992: 380).

How is this pattern of thinking in polarities promoted? The integration of contradictory values and needs is not easily accomplished for those habituated to an either/or mentality. It requires letting go of efforts directed at maintaining a static structures in favour of process orientation and complementarity. A process is essentially a flow. A river is a stable structure, although not static one. It is a constant flow of changing elements. The body is a flow -- almost every bit of it being replaced each year. Organizations represent flows of human and physical resources, and so too is society. This process view is readily reflected in Schumpeter's description of "chaotic change". "*As goals become ambiguous and means-ends relationships become less reliable, the governance system can only govern itself by becoming capable of learning both its goals and the means to reach them* ***as it proceeds***" (Paquet, 1995: 5). Where 'solid' structures can be defined by specific qualities and processes, evolutionary processes in particular, often involve complementary activities, such as the combination of generation and degeneration in the process of renewal. Attempts at explicit descriptions of process structures tend to be 'snapshots' that do not fully incorporate the complementary nature of sub-processes.

"*Process thinking does not know any sharp separation between opposite aspects of reality. It also transcends a dialectic synthesis of opposites, ... there is only complementarity in which the opposites include each other*" (Jantsch, 1980). The reconciliation of these complements lies outside the particular level of their activity and is embedded in the context of a larger whole. Mey states that "*society as a whole can be viewed as a combination of very different dynamic totalities*" (Mey, 1972: xv) and thus transcendence, the move from one level of dynamic totality to another, becomes the key to harmonizing contradictory social tendencies without compromising their individual contributions and significance.

"*Evolution questions the principle of democracy in a very profound way. A democracy can only be creative if it admits and even furthers fluctuations. But this requires a new attitude toward the majority principle which basically is on the side of [status quo] confirmation and meets novelty with distrust or even open hostility... Wherever democracy has functioned well, the role of individual imagination has been tacitly tolerated or even supported... Perhaps the most profound political paradox of our time lies in the need for 'elitist' fluctuations to turn self-determination into evolutionary, creative self-transcendence. The only alternative is equilibrium -- the equilibrium of spiritual, social and cultural death*" (Jantsch, 1980:270).

Fields of Force

To better grasp the dynamics of BGS relations, Boulding introduced a framework, the Boulding Triangle (below) to depict a variety of social governance relationships (exchange, coercion, and

reciprocity). Depending on their position in the triangle, either more to an apex or to the centre, institutions would reflect greater emphasis on, or balance among, the relationships embodied by the apex positions.

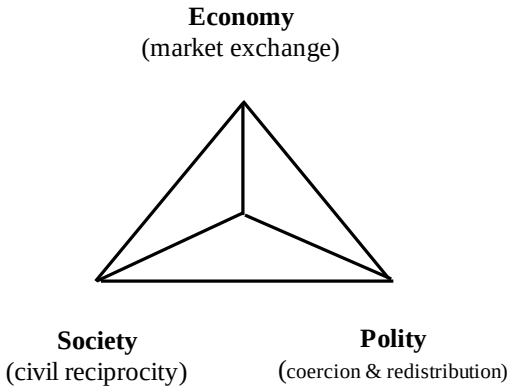

Fig. 15 - The Boulding Triangle

In recent history, the apex of society tended to be minimized and social institutions resulted from the dynamic tension between market forces and interventionist governments trying balance the individualistic orientations of business with the needs of society at large. Since the 80's, however, the importance of the government sector has been declining and the contribution of the third sector growing, giving rise to a more three-way dynamic. An equilibrium position could be defined as a sum of forces exerted by each apex of society.

The dynamic between sectors has been largely based on control -- control of financial resources, physical resources, human resources, control of public opinion -- the premise being that the goals of the institution could only be met by putting the necessary resources under direct control. The ability of an actor(s) to exert more control than another would shift the equilibrium position in the triangle.

Three recent changes -- globalization, the pace of change, and the growing complexity and interdependency among all elements of society -- have considerably weakened the ability of any sector to exert environmental control, and so dominate the texture of social institutions. The recent growth of the third sector has been by default, as business and particularly government retreat from areas where their control and influence have been waning. For instance, Day and Devlin report that for every 1% decrease in government spending on social programs there is a corresponding decrease of 2.8% in charitable contributions by corporations (Day & Devlin, 1993). The slack has been partially picked up by third sectors organizations -- charities, religious groups, civic and ethic associations, women's groups, and environmental groups -- whose current total contributions to society have been estimated economically to be about 24% of GDP (Paquet & Roy, 1996: 88). The recent growth in the influence of the private sector can be considered to be due more to a rapid relative decrease in the influence of government and a shift from federal levels to provincial and municipal levels than due to a growing ability of the private sector to project greater control over the environment.

Over the last forty years there has been a continuing effort to better understand the forces acting between participants of BGS by embedding them in the context of social fields. As the knowledge of the behaviour of physical fields became more generally accepted, social scientists began trying to apply these field theoretic models to social phenomena. The changes in these models over time reflect the increasing impact of quantum theory.

The first to begin using field metaphors was Kurt Lewin. Using the field definition he got from Einstein -- a field was a totality of coexisting facts which are mutually interdependent -- Lewin developed a field model for human behaviour.

"*Social life produces forces, which we can quite well think of as localized in individuals, ... Every person acts within a field, which is under the causative influence of other persons, of the ecological environment and of himself*" (Mey, 1972: 105). The consciousness of an individual human being is the unit of a social field and as it projects itself onto other people it induces fields of conflict or co-operation. The collective effect of these individual fields-of-force would produce larger totalities -- families, groups, organizations, communities -- which would be autonomous from the individuals that created them to a certain extent (Mey, 1972: xv).

The fundamental idea of Lewin's theory was that any perpetuated social condition represents an equilibrium of forces, which may alter or be altered by any change in the forces involved. "*The social role behaviour of individual members of society depends on the power and communication network around them... and on what they receive from this network*." (Mey, 1972: 155). Mey points out that, "*every society has a specific network of influences, and when these change, it means that society itself is changing*." (Mey, 1972:154). Society changes as a collective response to changes among individuals and "*any individual person adjusts himself in different field of influence which he feels will tend to consolidate him*."

Lewin's field-of-force metaphor developed as a consequence of gestalt theories of holism. The model remained pretty much a metaphor for furthering discussion, but it did not place too much emphasis on any mathematical treatment of field-of-force relationships, and it held tightly to the distinction between objective and subjective realities and to linear rationality.

In 1987, Melin attempted to enlarge upon the field-of-force metaphor to describe the forces emerging from human actions in an industrial context. His reasoning was that current efforts artificially isolated critical elements and did not adequately treat the holistic quality of fields of industrial relationships. "*Field theory*", as he said, "*finds it advantageous, as a rule, to start with a characterization of the situation as a whole*" (Melin, 1987: 26).

"*A force is something that leads to changed conditions in an industrial field. A social field is never without change: there are only differences in the amount and type of change*." The relative positions of actors within the field represent the structure of the field and the relative potential differences among the actors represent the basic possibilities of movement and change. What happens between actors depends on the strength and distribution of forces throughout the field. "*The core of an industrial field is a cluster of organizations connected to each other by resources dependencies. Within it we also find interest structures and rules of structure formation*." (Melin, 1972: 27).

The industrial firm together with its environment constitute a field-of-force. Three forces govern change among firms in an industrial field --

1. **External driving forces** which are long range forces which operate from outside a network of interlaced firms and have a general and deterministic impact on field actors. They include --

- demand forces, dependent on life cycle phase
- policy forces, such as economic policies carried out by national or international organizations like WTO, NAFTA, & OPEC
- knowledge and technology forces
- international labour forces
- growth forces as new actors enter the field
- scaling forces from the need for economies of scale and capital concentration

2. **Strategic forces** which are intermediate range forces because they result from actions of field firms and determine the relations among other field actors. Changes in the field as a whole cause firms to adapt and strategic actions of firms to adapt cause the networks of relationships in the field to reorient themselves. The industrial field thus responds dynamically to its own presence.

3. **Internal forces** which are short range forces because they result from the internal characteristics of the firm. The culture and values held by managers and employees define the collective character of the organization against which external criteria are referenced and from which a continuing pattern of management behaviour is evolved. Strategy is the result of this pattern of management behaviours and yields coherent, sense-making mechanisms for action in the industrial field.

Whereas Lewin and Mey tried to maintain the subject - object dichotomy, Melin reminds us that "*it is human beings who act in industrial firms and fields, and their reality is socially constructed and based on subjective interpretations. Events and situations are open to multiple interpretations*". Each actor makes subjective constructions of reality and in consideration of this, Melin recommends that "*the focus ought to shift from characteristics of the objective environment to characteristics of the attentional processes by which organizations shape their relevant environment*" (Melin, 1987: 29). It is an emphasis which focuses on the more internal aspects of 'social learning', developing those human capacities which permit social learning to take place.

Melin suggests that the above three forces, represent three different perspectives, which have to be combined simultaneously in order to adequately describe the dynamics of industrial fields. Moreover, the need to understand the 'mental maps' used by actors to enact strategies is primary -- "*by improving the capacity for self-reflection, 'to see oneself as an enactor of one's world', gives meaning to the internal forces behind change and stability in industrialized fields*" (Melin, 1987: 30).

In the social field theory developed by Rummel, the analysis of social behaviour, particularly in the field of international relations, is treated much more rigorously. Rummel's field model has been used to successfully to describe a number of national and international events by breaking the field into attribute and behavioural components and using vector analysis and the tools of quantum theory.

"The philosophy of social field theory is that behavior is the consequence of the total situation, and that this situation forms a field consisting of social characteristics, or attributes, which

stand in definite relation to each other. Behavior, moreover, is relative to other behavior -- to a context -- as well as to the relative similarities and differences of social units, such as individuals, groups, or nations, and their attributes. These attributes and interactions between social units constituting behavior form bonded systems which define the total situation, and in which social units can be located. These systems have persistence over time, while the position of social units within them may change quite rapidly" (Rummel. 1977:18).

"*Social reality is theoretically a field consisting of the attributes of social units [such as individuals, organizations, communities, regions, and nations] and their interactions. Attributes are those characteristics by which a social unit can be differentiated from all other social units. These may be such distinctions as size, shape, income, education, race, values, or geographic location. The behavior that social units direct toward each other are their interactions. They involve behavioral acts, that for nations as social units may be exemplified by threats, boycotts, state visits, international conferences, war, trade, and the like*" (Rummel, 1977: 23).

"Simply put, the theory is that attributes and behavior comprise interrelated wholes, within which behavior and attributes form distinct patterns or dimensions. Within this whole, the patterned behavior of any one nation is a consequence of its differences from others on the various attribute patterns nations manifest. Thus, if wealth, power, and totalitarianism are such patterns, then differences and similarities between nations on them will effect their patterned behavior" (Rummel, 1977: 484).

Another approach to describing the forces between BGS actors is in terms of non-equilibrium conditions acting upon a social structure with local dynamic stability. Given a certain condition of environmental entropy, relations between government, business and social sectors will adjust themselves until a temporary state of stability is reached. The resultant state is not predictable in advance but does represent temporarily balanced states of supply and demand, freedom and security, community and autonomy. When environmental conditions change, structural tensions arise and coherent individual fluctuations cause a realignment in the BGS field and a transition to a new steady state (Prigogine, 1984; Jantsch, 1980; Dahmen, 1988; Weiss, 1992).

The "*growing insight that the international system is beyond the 'stable state', and that in a dynamic Universe it has in fact never been in a stable condition, [has] had the result that all attempts at 'stability' and stabilization policies are being met with increasing scepticism*" (Weiss, 1992: 376).

Some of the components of environmental change that are impacting social stability are technological breakthroughs, population explosion, urban agglomeration, and ecological disruption. "*One of the most pressing problems is the explosive increase in data which makes it all the more difficult to gain relevant information*" (Weiss, 1992: 378).

According to information theory, an increase in information in a system increases the number of alternative states a system can exist in and so increases the entropy, or disorder, of the system. Thus, the exponential growth of information is, probably more than anything else, the main contributor to the destabilization of social systems. Information that is not self-referenced is just ignorance, non-relevant data. Information that is self-referenced is knowledge and that

knowledge has the ability to organize other knowledge around it. It is the self-organization of knowledge that directs individual social fluctuations toward the manifestation of coherent, evolutionary consequences.

Countries that have successfully embraced this challenge of information growth opted for outward-looking policies and a strategy of permanent, flexible adjustment, and the pragmatic development (i.e. dynamic BGS balance) of new regulation concepts and management styles. Such countries include - Taiwan, Singapore, Hong Kong, and Cyprus. Those countries that adhered to inflexible, inward-looking policies that tended to restrict the growth of information alternatives (e.g. India, Pakistan, Egypt and China) failed to risk the transition into the more dynamic and uncertain global economy are paying the price in terms of prosperity and social turmoil.

"*The increase in turbulence can be interpreted as a consequence of impeded evolutionary change. Processes of adjustment that would take place relatively smoothly without intervention to strengthen the status quo, are blocked and the unavoidable transformation takes on turbulent forms. In this respect, turbulence is caused to a considerable extent by the institutions themselves*" (Weiss, 1992: 378).

Turbulence should not always be considered unfavourable for it can represent, as we have seen in earlier discussions of non-equilibrium systems, transitional stages to higher levels of complexity and order. This is true in a social sense as well as a physical sense. Deiter identifies six components of turbulent systems that predict survival:

- sensitive early diagnosis of trends and increased environmental scanning, both public and private
- flexibility and ability to adjust
- ability to creatively develop a diversity of possible approaches
- a process of continuous individual and social learning
- accumulation of technical-scientific and innovatory *potential* for future challenges
- application of *self-organization* as the fundamental organizational approach (Weiss, 1992: 383)

Probably the most fundamental, certainly the most abstract, description of social interactions (Hagelin, 1987) postulates the idea that the social field is indeed a quantum field; that the unit of the field is individual consciousness; and that the nature of this field is a unified field of consciousness. Hagelin argues for a specific identity between the non-dualistic condition of self-awareness (pure subjectivity) and a unified quantum field (pure objectivity) based on evidence of field effects of consciousness (Orme-Johnson, et.al., 1988; & Dillbeck, et.al., 1988), structural and qualitative correspondence, subjective descriptions of non-dual consciousness, and the need of a unified quantum field theory to preserve a single degree of freedom.

Such a treatment of a social field has some interesting consequences. First, it makes sense of the recurring contributions of subjectivity to social reality. I think of it in the way in which Hans Selye once described how he arrived at his concept of stress in the body -- he remarked that no matter what disease a person seemed to be suffering from, they always looked sick, implying a

generalized response of the body to a variety of pathogens. As most writers quoted in this submission refer to some degree of subjective participation in reality, maybe there is a generalizable condition of subjectivity that is non-local in nature. A quantum field of consciousness would be just such a thing.

Second, a field of consciousness helps deal with the question of why such a close parallel exists between objective and subjective reality, nature and mathematics. The laws of nature expressed in both subjective and objective realities have a single unified source. Third, it suggests why such tight coupling exists between different sectors of the BGS as each would be expressions of the same underlying field of social consciousness. If we imagine a type of quantum superposition of individual excitations of consciousness, it becomes easier to understand how small influences can quickly grow to major significance. Fourthly, it adds justification for the need to develop learning capacities because in an environment of ever-increasing informational entropy, consciousness is the only self-referencing mechanism that can convert data into knowledge.

In the context of a social field of consciousness, Homer-Dixon's argument (Homer-Dixon, 1995) relating social ingenuity and resource scarcity represents a form of local symmetry existing between a field of social consciousness and a resource field. By way of comparison, Sir John Eccles, the famous English neurologist, described a similar consciousness-matter connection in the astonishing way in which consciousness moves atoms, molecules, and neuro-peptides around in the brain (in Chopra, 1989: 65).

Since creativity has been correlated with optimally functioning awareness (Maslow, 1962; Orme-Johnson & Haynes, 1981; & Travis, 1979), Homer-Dixon's 'ingenuity gap' could be overcome by efforts to develop social creativity by directly enhancing individual consciousness. The reason for the interest by some authors (Hagelin, Jantsch, Capra, Hill, Prigogine, Weiss, Chopra, Wigner, Bohr, Bohm, and others) in Eastern philosophical traditions can be explained partly by the specific experiential techniques to develop consciousness provided in these traditions. "*If objects in the world are fundamentally constituted out of their relationships, if everything is in some sort of relationship with everything else, and if consciousness is a necessary aspect of existence -- all of which is strongly suggested by quantum physics and ecology -- then much of Eastern thought moves to a central place of importance*" (diZerega, 1991: 78).

Ecology & Environmental Harmony

The promotion of classical dualism has, as we have seen, alienated man in a world of objects that have little or no importance of their own. "*If every boundary carries technological and political power, it also carries alienation, fragmentation, and conflict -- because when you establish a boundary so as to gain control over something, at the same time you separate and alienate yourself from that which you attempt to control*" (Wilber, 1981: 132). As we have also seen, environmental and human process structures are not controllable by drawing boundaries or through contextual extraction, but by catalytically directing the internal flows to more desirable levels of organization. The corollary of Wilber's comment is that by removing boundaries, building or acknowledging relationships, and by identifying the similarities between ourselves

and the environment us, we can more fully appreciate the inherent value of that environment and better direct its processes to more mutually beneficial ends.

Rather than embracing an attitude of environmental harmony, the classical view emphasizes domination and power through what diZerega calls "**architectonic violence**". Architectonic violence "*imposes a preconceived ideal upon a self-organizing system, forcing it to exist in a state fundamentally alien to it and disruptive to its symbiotic relationship within a larger such system*" (diZerega, 1991:82). The characteristics of architectonic violence are:

- the 'architect' is aloof from the natural or social resources in need of 'development'
- a resource is a means to achieve an end separate from itself
- architectural domination -- need to conquer rather than adapt or coexist
- adherence to individualism and denial of reciprocity, complexity, and non-linear relationships

Examples of this architectonic violence include, the creation of large-scale monoculture agriculture, eco-tourism, the 'management' of forest reserves by forestry companies, and in a social sense – centralized, economic planning. In order to achieve dominance, the environment can no longer evolve, and with it neither can mankind.

While "*human beings, and the world as a whole, may well be connected in more holistic ways than have heretofore been appreciated in our culture*" (diZerega, 1991: 71), the reductionist attitude of separating man from an environment has blinded us to the value of relationship and reciprocity. The growth of the environmental movement, in response to a growing awareness of the impact of ecological thoughtlessness on the quality of human life is, in itself an indication of the reciprocal nature of man's relationship to the environment. Leopold describes the environment as "*one organism. Its parts, like our [social] parts, compete with each other and co-operate with each other*" (Leopold, 1970: 190), a view supported and extended by James Lovelock's "*Gaia Hypothesis*" (Lovelock, 1979: 1988) that the Earth itself is indeed a living organism.

Society, like any other ecosystem, does not become chaotic because it is self-organizing. Minimal conditions of order in the form of adherence to some basic procedural rules permit a society to form process structures which can be maintained and evolved via individual contributions à la Prigogine and Jantsch. It is not successful adaptation to a given environment in a Darwinian sense which is the foremost formative factor in life, "*but the web of ecological processes in an environmental system which shape physiological and behavioural patterns which subsequently may become genetically anchored*" (Jantsch, 1980: 145).

Whereas evolution is an open-ended process, the current round of discussions on the limits of social growth suggests we may be reaching our limit of environmental dominance. Over population concerns, concerns over ecological quality and global warming, structural unemployment, changes in social demographics, and the rising gap between rich and poor "*are calling into question the crucial dimensions of our social organization*" (Paquet & Roy, 1996: 145).

Attitudes of dominance, contextual extraction, and individualism necessitate that public and private initiatives adopt policies that minimize scarcity. Otherwise, as we are observing, society suffers from growing failures due to the increasing scarcities of space, clean and safe environments, jobs, resources to provide for an ageing population, and perceived fairness, that are perceived as failures of public institutions to control the environment. In the traditional economic sense scarcity in any national resource is compensated by the application of the creativity of its citizenry so that a certain level of satisfaction can be maintained.

However, as Homer-Dixon points out, this is not always an inverse linear relationship (creativity = 1/ scarcity) and that as scarcities increase, even though the demand for creativity is increasing, the ability of the social organization to supply needed creativity diminishes. "*Severe scarcity, I will therefore argue, can simultaneously increase the requirement for and impede the supply of ingenuity in poor societies, producing an 'ingenuity gap' that may have critical consequences for adaptation and, in turn, social stability*" (Homer-Dixon, 1995: 37). In the context of the limits of social growth, the distinction between rich and poor countries is minimized and the growing global scarcities are creating a human 'ingenuity gap' and "*calling into question*" how we fundamentally organize ourselves.

A more quantum approach recognizes the homologous roots of man and his environment, that they are both part of a global ecosystem, and that the evolution of one requires the evolution of the other. Harmony with, not dominance over, the environment will be the key to unlock the true value of the environment, which is not market value, but the value of a partnership that allows us to grow and prosper in open-ended evolution. Private and public organizations will have therefore a responsibility to foster balance in the global ecosystem by developing attitudes of social and environmental obligation, and providing the infrastructures for the development of the capacity for creativity and ingenuity, the capacity for knowledge, and the capacity for co-operation and co-evolution, which together will allow coherent individual fluctuations to drive society well beyond social equilibrium into higher levels of organization.

"*We are witnesses of an emerging search for an 'evolutionary ethics' of responsibility for the further continuation of human life, embedded in the general constraints of nature, recognizing the principles of evolution such as openness, non-equilibrium, and the positive role of fluctuations. Linked with this is an evolution of value systems that are compatible with the requirements of global survival and that include evolution of human consciousness. Values are likely to have an ever more explicit impact on the direction of individual and social behaviour in the future*" (Weiss, 1992: 384).

Summary of Quantum Paradigm & Public Policy

QM Paradigm	Human Corollary	Public Policy Ramifications
Reality is unified wholeness. It can appear in discreet units of excitation that remain imbedded in a network of relationships	Human beings are spiritual beings - expressions of an underlying wholeness that is shared with the environment. An individual is defined by the quality and density of interrelations, and the networks in which one participates. These networks imply a need for obligation, trust & co-operation.	Focus on relationship, wholeness, and co-evolution. Lessening emphasis on individual rights, and greater emphasis on **community rights, social ethics, and information sharing**. Instead of principle of separation of powers, the principle of **co-operation & inter-dependence.**
Uncertainty - knowledge has its limitations. Reality is approx-imate and stochastic if not grasped in its entirety	Individuals are unique, non-substitutable, often acting irrationally and with conflicting purposes. Human behaviour is not predictable except stochastically	Given uncertainty, governance policy tries to **create response potential** by developing vision, social learning, and learning capacity. **Harmonization** brings mutual satisfaction among different social elements & broadens the opportunity for more complex organization. Devolution and subsid-iarity minimize effects of uncertainty.
Only context dependent generalizations are possible	Man is not independent from his environment. Due to reciprocity and mutual inter-dependence, the primary human behaviour must be sharing	Critical elements can not be isolated & dealt with separately from the systems they impact. Policies should promote a culture of **shared fate**. Social interests, the expressions of the BGS whole, demand the ability to marshal the required human and natural resources at the required time for the required purpose. Freedom is the knowledge that that support will be there.
Interdependence of observer, process and observation	The world is an extension of our consciousness and different states of consciousness produce different knowledge. Reality is tripartite - object, subject, and process, the most significant of which is subjective. Knowledge is not value-free.	Society is a process to maximize individual growth through interactions with others. Principle of **participatory democracy** - general participation of polity because the lack of objective reality prohibits virtuous men from representing the subjective perceptions of polity.
Space & time are not absolute and impact events	Geography, culture and time are determinants of human behaviour, resulting in a variety of acceptable behaviours among and between regions. Adaptive periods are short.	**Decentralization, devolution, & subsidiarity** to ensure the appropriate-ness to meso levels and to cultivate regional comparative advantages. Short adaptive periods require more organic structures & **social learning** to maximize flexibility and responsiveness to environmental conditions.

QM Paradigm	Human Corollary	Public Policy Ramifications
Existence of non-linear causality, non-locality, & coexistence of opposites	Human behaviour is often irrational and unpredictable, desiring contradictory outcomes simultaneously. Individuals can influence society as a whole.	**BGS is non-linear process** structure with only temporary states of stability. Conformity promotes stability but only coherent individual contributions promote evolution. As stable states are not predictable, goals and means must be developed on the go. **Transcend-ence** among competing interests creates harmony that benefits everyone.
Forces result from field fluctuations that maintain symmetry	The unit of individual consciousness is the unit of a social field like a thread woven in a tapestry. As individuals adjust to consolidate themselves in response to some influence, the social tapestry is pulled. Individual fluctuations drive social evolution	The basis of BGS is a social field. In changing environment government must be outward-looking, a **catalyzer** of social change, **continually reorient-ing** itself, and **dynamically balance** regulation and the promotion of ingenuity. **Visionary government** sets the direction and the infrastructure and facilitates co-operation among players.
Man must live in harmony with the environment	Man is an integral part of the global ecosystem. The evolution of one depends on the evolution of the other. The environment has an intrinsic value that is related to our own self worth.	Public and private organizations have a responsibility to **foster social and environmental obligation, subjective capacity, and evolutionary ethics**. Minimization of 'social friction' & factors impeding the development of social ingenuity to maximize resources & evolution.

CONCLUSIONS

The need for new guiding principles is more than evident by the requirements presented here and in more detail elsewhere. The main problem of social organization is not so much a lack of dedication, goodwill, or sincerity, but that the fundamental template, or paradigm, for integrating diverse economic, social and political elements is not adequate for dealing with the world as it is, with people as they are, or with human behaviour as it is. The world is quantum mechanical, people are unique and unpredictable, and behaviour is embedded in a network of subjective perceptions and environmental relationships. The view of the world embodied in liberal democracy is incomplete, and thus the paradigm must shift. Although the classical basis of liberal democracy has been outdated for some time, the shift to a quantum view of social organization is delayed because it does not reinforce our day-to-day experience as readily as the classical physics view. In spite of our technologically based culture in which scientific advances tend to be diffused into society with great ease, and the fact that quantum theory is an extension not a replacement of classical theory, the adoption of quantum knowledge remains largely an esoteric academic consideration.

How might this shift be effected? In one word -- education. While on the one hand the "*life is a networked thing*", and society an evolutionary process, the training we offer our citizens tends to be directed to compartmentalization, individual values, 'objective' science, and competition over co-operation. While it has been recognized that development of infrastructures to enhance social learning are a requirement for social growth, the development of the necessary capacities to empower social learning at every level of society are generally and fundamentally lacking. These are the very human capacities of learning ability, intelligence, creativity, perceptual acuity, foresight, moral judgement, compassion, and generosity.

"*We must seek, somehow, to engender a persuasive mythology, wherein people believe it to be natural, desirable, and possible for humans to be perpetual learners as individuals, groups, and organizations, and to believe that governments rightly and naturally are a prime vehicle for empowering learning*" (Michael, 1992)

As a small contribution, I would like to suggest that in the delivery of education it is important that the perception of the whole not be lost. Holistic education can begin simply with the perception of where a single part of knowledge fits into the larger scheme of things. It is Jantsch's and Hagelin's suggestion that quantum principles and the principles of evolution represent homologous knowledge, knowledge that can stitch together the many fragments of human thought into a rich tapestry of experience. **Figure 15** below represents an example of efforts at the *Institute of Science, Technology and Public Policy* (ISTPP) in Iowa, to develop teaching aids to help students integrate diverse elements of a management education into a single whole and then to link that with their conscious experience. They are used at the beginning of each course and are on display in every class, so that the student does not lose sight of the whole while concentrating on any part of knowledge. In addition, ISTPP emphasizes not only exposing students to a wide range of information, but also in developing the container of knowledge, individual consciousness, to enable the absorptive capacity students to increase.

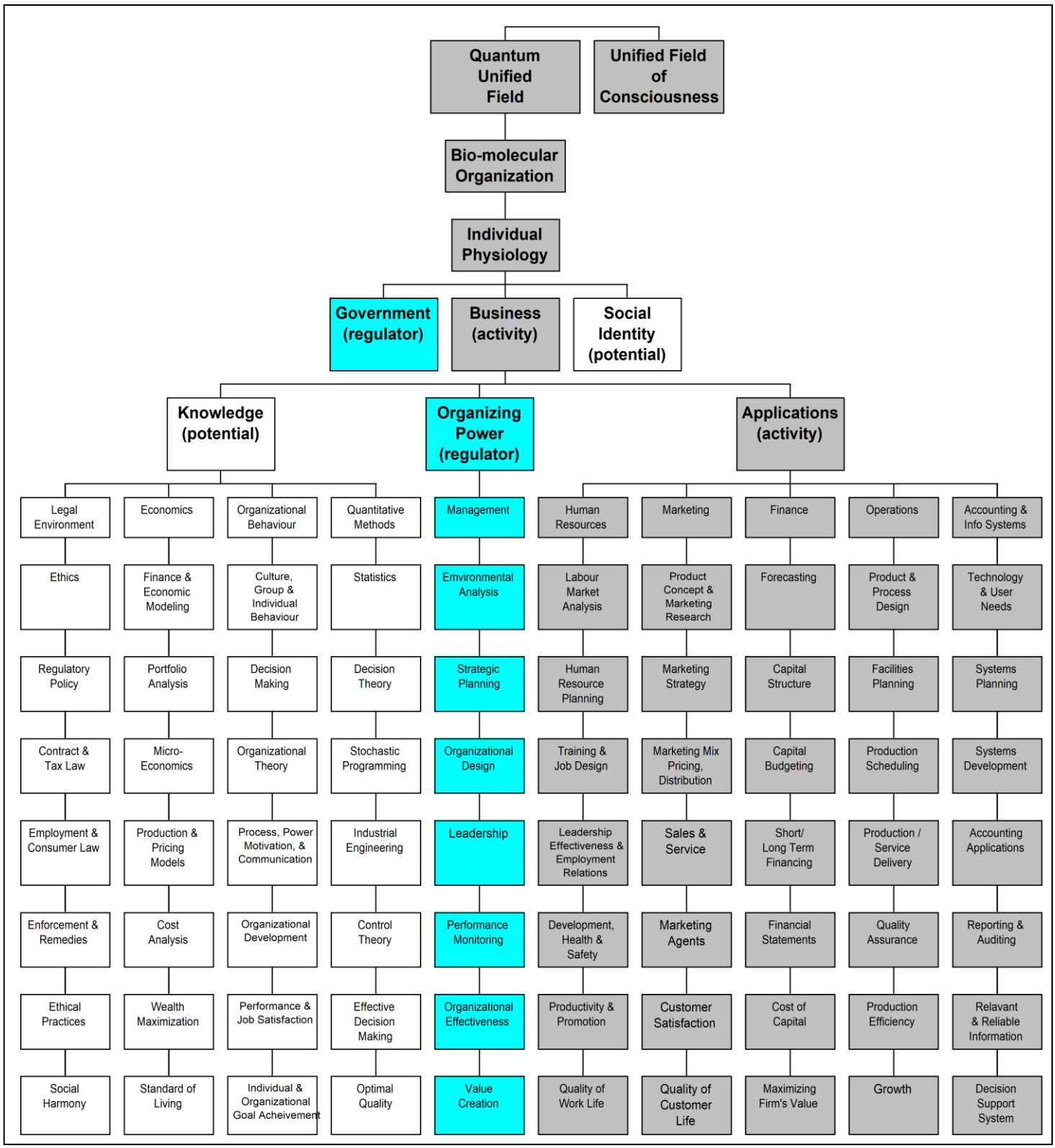

Fig. 15 - Sequential Development of Business Administration from a Unified Quantum Field

Adapted from *Unified Field , Management & Administration*, teaching aid, Institute of Science, Technology and Public Policy, Fairfield, IA, 1993

It is interesting to consider that the Boulding Triangle looks very similar to the QM knowledge framework presented earlier. If we compare the Hilbert space to society, the QM operators to government, and vibrational mode to business and use the same dynamical relationships, we have government defining the potential, symmetries and structures of society while simultaneously directing the evolution of business activity via catalytic processes.

Business, for instance, represents the specific functions and activities that realize the potential latent in society's members. System stability is achieved through the regulation of those activities by government for the maximization of socio-economy. Society represents the potential of the BGS as a whole. It can be subdivided into numerous and smaller interlocking potentialities or 'basis vectors' that can be described in terms of ethnicity, language, cultural background, education, skills, demographics, and points of view. Yet each 'basis vector' represents a valid starting point for a particular business activity. The system potential of society is thus composed of many complementary, non-exclusionary elements.

A key contribution of this framework is that the apexes represent only perspectives. Fundamentally, they are the same thing, a social totality that is more than the combination of business, government, and society. This three-in-one approach suggests that any institution, public or private or not-for-profit, ***with reference to society as a whole***, contains elements of all three perspectives. Any business must be aware of the social 'basis vectors' to supply its human resources as well as the social and ecological environments upon which its activities impact. Similarly, each business involves governing -- directing change into more evolutionary conditions while regulating themselves through a process of continual social and environmental scanning.

Under ideal situations all three BGS perspectives are so intimately correlated that balance within the overall system is maintained. Maybe this is why it would be "*inane to try and separate them*". As an example, it is not at all realistic in a quantum framework to consider governance systems that emphasize 'market forces' exclusively, while minimizing the importance of government or of the third sector. The difference between private sector and public or third sectors is only a matter of convenient perspective -- they are fundamentally the same social phenomenon.

"*Government-business relations are at the core of the process of adjustment in modern socio-economies. The capacity of the state to catalyze co-operation among stakeholders and to design creative compacts between business and the other members of the production/innovation team determines the capacity for organizational learning and effective adjustments*" (de la Mothe & Paquet, 1994: 115)

Finally, an area that requires closer examination is the possibility of local symmetry within a social field of consciousness of the type implied by the ingenuity / scarcity scenario. de la Mothe and Paquet suggest going to the most broadly based unit of analysis, "a*ny attempt to build [a constructive system of foreign trade] on evolutionary modelling and social learning needs to start focusing on a broadly relevant unit of analysis*" (1994: 113). I would suggest "consciousness as a field" is about as broad a unit of analysis as you can get.

Is consciousness really identical with a quantum unified field as Hagelin suggests? If so, how could this be tested? Might a field of consciousness be experimentally at least as aloof as proving string theory or grand-unified theory? Possibly, but our knowledge of quantum superposition and the examples of superfluidity and super-radiance suggests that if consciousness is quantum-like, it may well be veiled behind the activity and entropy of daily life. If a means could be found to minimize the superficial activity of consciousness, man's quantum nature might emerge, most likely as some form of collective phenomenon. Several authors (Wallace, et. al, 1971; Jevning, et.al., 1978; Capra, 1979; Jantsch, 1980; Dillbeck & Orme-Johnson, 1987), suggest that some eastern meditation techniques can isolate consciousness in its pure state and that that experience exhibits physiological corelates distinctly different from the three generally recognized major states of consciousness -- waking, sleeping and dreaming.

Recall also that a requirement for evolution in steady state transitions is individual fluctuations that are amplified internally by the coherence of the existing state. A means to expose man's quantum nature may well provide institutions of governance with a catalytic tool to align elements of the BGS, that is to generate background conditions of social coherence, against which non-equilibrium fluctuations would be more likely to take root. Although the specific nature and content of individual creativity might be hard to determine in advance, the use of subjective technologies to enhance social field coherence would allow governance bodies to exercise more process control over evolutionary development. This suggestion is supported by evidence that subjective technologies can impact broad sociological and economic variables (Cavanaugh, 1987; Orme-Johnson, et.al, 1988; Gelderloos, et.al., 1988).

In conclusion, I think that our choice is to recognize that we live in a quantum world, that the whole of the BGS is a process structure, and that it responds to an evolutionary dynamic. In this context, effective governance is effective management of the ongoing social transition process. The price of this recognition is the two-edged sword of continual adjustment and the reintegration of humanity and our environment into our increasingly technological world.

"*We know that societies are immensely complex systems involving a potentially enormous number of bifurcations exemplified by the variety of cultures that have evolved in the relatively short span of human history. We know that such systems are highly sensitive to fluctuations. This leads to a hope and a threat: a hope, since even small fluctuations may grow and change the overall structure. On the other hand, this is also a threat, since in our universe, the security of stable permanent rules seems gone forever*" (Prigogine, 1984: 313)

Section 2 - REFERENCES

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