Steps to the Threshold of the Social

Part 1: The Mathematical Analogies to Dissipative, Autopoietic, and Reflexive Systems.

Kent D. Palmer, Ph.D.

PO Box 1632
Orange, CA 92856 USA
palmer@exo.com

1. Abstract

In this paper it has been explained how general systems theory is extended to cover three special systems theories which approximate the dissipative, autopoietic and reflexive systems through their analogy with the complex, quaternion, and octave number systems and their algebras. This presents a new paradigm for which rethinks General Systems Theory in terms of specialized systems theories involving order production, life, intelligence, and society. It discovers that there are specific thresholds of complexity at which these different systems arise unfolding from each other which have analogues in the mathematical theory of algebras. Each of these thresholds of complexity are steps from General Systems Theory toward the definition of the social. This new paradigm gives a mathematical basis to the definition of living systems and social systems for the first time. It allows us to create a genuine extension of autopoietic theory into the realm of the social and thus resolves one of the problems of autopoietic theory (i.e. how it applies to the social phenomenal emergent level). It also allows us understand the relation of autopoietic systems to their underlying dissipative systems.

In the course of the paper the disciplines of Social Phenomenology, Computational Sociology, Autopoietic Sociology and Onto-mythology are defined and related to give multiple approaches to the field of dissipative autopoietic social systems. An inherent simplicity with a specific mathematical harmony and differentiation is discovered to underlie these diverse phenomena which connects them to each other

as different emergent levels that arise out of General Systems Theory and extend it into the realms of these specialized systems theories which explain the basis of some of the most important phenomena in the universe. The inherent complexity of these phenomena is also explained in relation to their simple foundational structures which are analogous to algebras.

2. Keywords

General Systems Theory, Autopoietic Systems, Dissipative Systems, Social Systems, Ontology, Algebras, Complex Numbers, Quaternions, Octonions, Acupuncture, Homeopathy, Psychology, Sociology, Social Theory, Computational Theory.

3. Software Design Methods, Computability, and General Systems Theory

In this paper we will take a series of steps from General Systems Theory to construct ever more special systems theories in order to define in a mathematically tractable way the threshold of complexity of social systems. Along the way we will define similarly dissipative systems and autopoietic systems. We do this in order to construct a consistent picture of the major building blocks in the theory of reflexive autopoietic systems. In a prior paper a version of the General Systems Theory of George Klir was constructed in which each stage of the manifestation of the general systems theory model was tied to the appearance of a methodological distinction. Order is not a monolith but can be divided into a lattice of more and more basic constituent types of order. Each kind of order has been called by George Klir a methodological distinction and their are five basic kinds or order in this lattice:

No Order (a pure distinction)
Partial Order
Partial Order with Distance
   OR Linear Order without Distance
Full Order (Linear Order with Distance)

We are used to dealing with full order in most systems applications. However, for certain kinds of systems such as software systems other kinds of orderings are important since some aspects of these systems are impossible to fully order. Close examination of the relation of orders to simulations of real-time embedded systems

shows that the lattice of orders are very important for the understanding of the relation of design and representational methodologies to these systems. The upshot of these discoveries is that there are four points of view on every real-time system (*Data, Event, Agent and Function*) and that two of these (*Data and Event*) can be fully ordered but that the other two (*Agent and Function*) viewpoints can only be at most partially ordered. The fact that these viewpoints with different ordering capacities must be juxtaposed to produce a full representation of a real time system causes fundamental problems in real-time systems design. It also turns out that the two kinds of methodological distinctions (Partial Order with Distance and Linear Order without Distance) which appear between Partial ordering and Full ordering within the methodological lattice are in fact related to the structure of real-time design methodologies. These two methodological distinctions are duals of each other and describe the structure of all minimal methods that serve as representational bridges between viewpoints. There are twelve such minimal methods which combine sometimes together and sometimes remain separate that connect the basic viewpoints on real-time embedded systems.

The fully ordered system description gives us the illusion of a continuous simulation of that system. Such a simulation for software is indistinguishable from the system itself. But that running simulation is arrived at by starting at requirements which are a series of independent distinctions and by applying the viewpoints of Agent and Function and representing the interaction of those functions with minimal methods finally arrive at a spacetime representation of the system that works according to its requirements. Such a system is said to be embedded in spacetime. There are four different possible embeddings in spacetime for any system representation. It is also the combination of these embeddings that render embodiments of the minimal methods. Since the illusory continuity of the fully ordered system must be turing computable in order to be executed as a simulation of the system these minimal method pairs of embodiments represent slices of a turing machine. Systems represented by minimal methods are partially computable and the composed systems represented by all the minimal methods are fully computable because of their homeomorphism with the turing machine.

All of this leads to the presumption that there is a general equivalence between a turing machine and a system represented by all the minimal design methods for real-time embedded systems as well as to the general formal-structural system such as that which George Klir defines. Software simulations of embedded real-time systems are the embodiment of their dual -- General Structural Systems. In other

words you can only build systems that have permutations of the General Systems Architecture and every simulated system embodies some permutation of such an architecture. In order to run such a simulation or compute the possible permutations of all possible systems architectures one must have a turing machine which is computable. There is a general equivalence between all possible simulations, all possible turing machines and all possible computable systems architectures.

In each case there is a chiasm embodied within the structure of this computable machine. In the case of the representation of the simulation of any possible system there is a chiasm between agent and function viewpoints which arise from their embeddings in spacetime. In the case of the turing machine there is the difference between the tape and the state-machine of the turing machine. Since the tape can represent state-machines we get the possibility of a universal turing machine that imitates all possible turing machines by reading their state machines from tape and executing them. Thus there is a chiasm between data and event within the turing machine. If different sub-turing machines can operate independently apparently simultaneously this is the representation of an illusion of agency. Similarly if different multiple turing machines are really operating simultaneously then this is the reality of agency. The performance of the turing machine may be seen by an intelligence to be intentional. This intentionality is the representation of functionality if it is only projected upon the turing machine. If the turing machine is itself intelligent and is acting intentionally then this is the reality of functionality. In the case of the architecture of general systems problem solving there is an epistemological lattice which operates on the object, source, data and generative levels of system behavior. Each of these levels embody meta-models and meta-structures that proliferate infinitely into higher and higher meta-levels. These two chiasmic structures both arise out of the source, data and generative levels intertwining at their lower levels but separating at higher meta-levels. Meta-models are the basis of changes of structural patterning. Thus these two represent the spacetime articulation of the patterning of the dynamic system. Meta-levels give patternings within patternings within patternings both in space and time. The interaction of these at the source, data, and generative levels forms a complex interference pattern that may render the dynamical system under study too complex to be understood. Each of these chiasms are different aspects of the same thing. Any given real-time embedded system will have chiasmic representations in relation to spacetime and autonomy/intentionality. If such a system is simulatable then these representations are slices of a turing machine that is computable. Such a

system is one example from all possible architectures of systems. Such architectures can be represented by the lattice of Epistemological distinctions derived by Klir and can be computed using a turing machine implementation that has itself a design. This is again a way of saying that every dynamic embedded real-time system that can be represented can be simulated and has one of the possible architectures from the list of all possible general systems architectures.

This may seem obvious but it appears that no one (known by the author) has previously made this connection between general systems architectures, their simulations by turing machines and their design representations. This is generally because the representation of real-time embedded systems is a relatively new craft that has grown up in industrial practice of designing software systems. Software design itself is a new discipline within software engineering. Software is a new kind of entity which is unlike most other kinds of entities that have previously existed. This new kind of entity has been analyzed in the author's paper on Software Ontology and by other authors. Software is a unique kind of thing which is very difficult to build. Recently software design methodologies have been developed on an ad hoc basis to attempt to represent the essentials of the structure of software. It has been the author's work to define the four viewpoints and the sixteen minimal methods that allow all possible essential aspects of software structure to be defined in two dimensional representations. The connection between software design methods and general systems theory was later made explicit by the author. These are dual meta-disciplines that mutually entail each other. Finally the discovery of the proof that embeddings of the minimal methods in spacetime are slices of turing machines allows us to understand how simulations are connected to general architectural permutations. The morphological matrix of all possible systems architectures is isomorphic to morphological matrix of all possible simulations and simulations are computable because their designs are partial turing machines that when completed can be computable. This means that if we design a simulation of a system from all possible design viewpoints using minimal methods to link these viewpoints then we will get a computable software system in the end. The only snag is that some aspects of the system cannot be fully ordered and so there is a disjunction between the fully ordered simulation embedded in spacetime and the autonomy and intentionality of that system.

4. Disjunctions between Continuities

It is because of this disjunction between certain design viewpoints and their

embodiments in spacetime that we need to study certain special systems beyond those described by general systems theory. There are three kinds of system beyond the general system that are of interest. They are the dissipative, the autopoietic and the reflexive/social systems. These systems only appear in very special circumstances in nature and one cannot have an autopoietic system that is not dissipative nor a reflexive/social system that is not autopoietic. In other words they build on one another. They define very narrowly a special kind of behavior that only a small number of general systems emulate. Each one is more narrow and specialized than the next. Yet they are very important to us because they represent an order/disorder inducing system, a living/cognitive system, and the social/ psychological reflexive system which are very important features of our world.

In a separate paper I have posited that these special systems are poised at particular thresholds of complexity with specific forms. To the point the dissipative system is poised at the threshold of complexity of the complex numbers and their algebra. The autopoietic system is poised at the threshold of the quaternions and Clifford algebra. The reflexive/social system is poised at the threshold of complexity of the octave (octonion) and the Cayley algebras. Each level of complexity is arrived at by doubling of the number of independent kinds of numbers that are involved in the algebra. The two final layers of special systems appear with weaker algebras which lack commutative and associative properties respectively. But these algebraic systems are the only ones possible that can appear as an extension of the real number system. The complex numbers are recommended by the fact that all the properties of addition, subtraction, multiplication, and division apply to them while they solve the fundamental problem of the solution of quadratic equations. Another point of interest is that there are no other possible algebras beyond these three that come any where close to giving us the fully intertransformable power of the real numbers and their algebra.

When we append the hierarchy of possible complex and hyper complex algebras onto the lattice of methodological types we obtain a very interesting theoretical formation. It is a formation that allows us to understand the structure of general systems by adding one layer of ordering to the next until we have constructed the level of complexity that gives us an illusory continuity that is simulatable and turing computable. But this level which corresponds to the real number then begins to fragment when we realize that we can have multiple real numbers that form vectors or form complex and hyper complex numbers. This fragmentation by the introduction of multiple simultaneous illusory continuities has a peculiar structural

form that appears as specific thresholds of complexity. These thresholds of complexity are exactly those at which the dissipative, autopoietic, and reflexive/ social systems appear. The hierarchy composes illusory continuity and then deconstructs it again. But the deconstruction is not equal to the composition. The composition is composed of sub-orders below the threshold at which illusory continuity appears. The destruction occurs because once illusory continuity is achieved then it becomes possible to have multiple simultaneous illusory continuities. These have specific algebraic relations to each other when held in conjunction. If they are not held in conjunction then one kind of real number cannot be distinguished from the other. Each level of ordering of conjugate real number lines approximates the algebras of the single real number line to a certain extent. Complex pairs have all the algebraic properties, quaternions lose the commutative property and octaves lose the associative property. Finally all properties are lost and there is no further degenerate algebra that can hold any more illusory continuities in conjunction. So we can decompose a single real number line into its sub-orders or we can hold in conjunction multiple illusory continuities of real number lines. There are only a certain number of these conjunctions that can occur mathematically and they form particular thresholds of complexity. Beyond these thresholds it is impossible to hold any higher number than eight illusory continuities in conjunction. This interestingly enough falls exactly in the seven plus or minus two range that working memory is adequate to handle.

 This identification of the thresholds of complexity of these special systems with the different possible algebras is important. It allows us for the first time to place what have been non-mathematically based theories of dissipative, living and social systems on a firm mathematical footing. Here we are not claiming that these phenomena in nature are reducible to these simple mathematical forms. We are instead claiming that the theories of these phenomena have an affinity with these complexity thresholds. This is to say that when we are representing theoretically the essence of the dissipative system then to the extent our theory approximates the structure of the complex number extension of the reals then it will be a more accurate theoretical representation. Or to the extent that autopoietic theory follows the form of the quaternions it will be a more accurate representation of the essentials of living/cognitive dissipative systems. Or finally to the extent social scientists and psychologists that study reflexive cognitive systems approximate the structures of octaves their associative Cayley algebras their theories will be more accurate representations of these phenomena. Why is this so? It is so because these systems are specializations of general systems and there is only one direction that

general systems can specialize which is through the conjunction of simulations. A conjunctive simulation is one that holds several illusory continuities together within the same formation. It is not one that allows the simulations to merely operate independently. Many such simulations are proposed and have been created today in which there is a society of the mind or where parallel distributed systems interact. However, complete independence of myriad simulations each producing an illusory continuity to behavior is not the same as holding some subset of these in conjunction for some period of time. When we hold them in conjunction we can apply algebras to them that are the minimal possible algebras giving complete intertransformability. There are specific thresholds where we can hold more and more (explicitly two, four and eight) independent strands together in conjunction while still not losing intertransformability. Two strands are still as intertransformable as one strand albeit by introducing a strange twist. Four strands loose the commutative property and eight strands loose the associative property as well. So intertransformability slowly fades from sight as we keep doubling the number of strands of illusory continuity we are holding in conjunction.

Parallel distributed computing has many ways of producing simultaneously many independent illusory continuities. For instance, a hypercube computer may have sixteen processors working independently or working dependently by exchanging information. Design of the interaction of multiple independent processors computing together or sharing information is covered by the set of minimal methods. These methods control the exchange of data between processors through communication channels and the relativistic loss of global time which necessitate understanding the interaction of processor worldlines via message passing scenarios. But what we are pointing to here is that there is a grey area between independence of processors and designed or even non-designed exchanges. We can instead hold the various illusory continuities in conjunction and view their interfering patternings in a single gaze. When we do this we can hold within our gaze two, four or eight illusory continuities at the same time. Their interference patterns when held in conjunction are understood via intertransformabilities controlled by algebras. These algebraic constraints weaken as we attempt to hold more and more illusory continuities together in our gaze. But it must be clear that holding illusory continuities in conjunction is different from merely allowing them to run open loop without reference to each other. It is also different from producing relativistic exchange mechanisms by which cooperation is effected "at a distance." Instead their is the fuzzy area in which two streams of illusory continuity effectively become a single hybrid steam within our gaze by being held in conjunction and

intermingling. We are severely limited as to how many processing streams can be held in conjunction simultaneously. In fact both short term memory and algebra collude to limit us to at most eight. Thus only a small part of a parallel distributed system of processors can form this hybrid combined illusory stream. In fact we are limited to at most a cube of processors. So our gaze cannot dominate even a whole hypercube. We can see these hybrid streams of conjunction as meta-gestalts arising on the background of a field of semi independent processors. As we later our gaze different processors might be brought into the meta-gestalts of the hybrid stream. As we narrow the focus to fewer processors then the intertransformability between the processors illusory continuities becomes stronger. In the hybrid stream we project the action of ordering principles that are seen as dissipative systems where only two streams of continuities of processors are combined into a single hybrid stream. But if we instead combine four illusory continuities into a hybrid stream at the quaternion level then we can project into that imaginings of artificial intelligence or life. We lose the power of the commutative property but gain asymmetries that can be interpreted as living/cognitive characteristics within the meta-hybrid stream of illusory continuity. If we go further we can alter our conjunctive gaze to combine eight processors into a single meta-meta-hybrid stream of presencing or artificial manifestation. That level of artificial continuity can be seen as supporting all the aspects of sociality in which the artificial cognitive living organisms bathe mutually enfolding one another. We lose the power of the associative property but gain further peculiarities in the structure of the hyper-hyper-stream of illusion which allows us to imagine the social and psychological characteristics that resonate with our own understanding of ourselves. In fact the hybrid streams are merely artificial mirrors into which we gaze seeing aspects of ourselves reflected in the distorted mirror of computational constructs.

5. Dissipative Systems

Dissipative systems hold two strands of illusory continuity together. They concern the situation where there are two orders that are in imbalance so that one order is displacing the other. Notice that if there is only one order there cannot be a dissipative system. Also if the two orders are in balance or stasis there cannot be a dissipative system. A dissipative system is when there are two different orders or ordering mechanisms that are out of balance with each other so that one ordering mechanism is disordering the other and creating a boundary between the two orders that is disordered or represents in some way an interference between the two ordering mechanisms where one is dominant and the other is being dominated.

This case has the basic form of vector arithmetic or the complex number system that holds the order of the real numbers together with the ordering of the imaginary numbers. The complex number system includes both imaginary and real numbers. The differentiation between the two is indeed imaginary because either number could be designated as real and the asymmetry between imaginary and real numbers is an illusion which comes directly from their conjunction not from the numbers themselves. In the case of the complex number system the reals are dominant and the complex numbers are subservient. We only actually see the relation between the two if we place the complex axis at right angles to the real axis. When we look at the field of these numbers what becomes apparent to us is the form of the mandelbrot set. The mandelbrot set is the most complex mathematical object known to man. This set is composed by iteratively taking each point and multiplying it by itself and measuring the rate at which it escapes toward infinity. All real numbers escape toward infinity at the same rate. The numbers that represent the intersection between real and complex have different rates of escape toward infinity. We will follow Deleuze and Guattari and call each of those escape velocity weights the line of flight of a particular point. Dissipative systems have an interface between their two orderings (that of the system and that of its environment) which is very complicated. It involves myriad lines of flight that produce and infinitely complicated pattern which is still determinate. This variable instability of individual pairs of numbers that represent the conjunction of each point in one illusory continuity with a point in the other illusory continuity with which it is held in conjunction tells us that the individual orders that are actually simulated in each of these continuities will have a very complex interaction. It is as if the individual pairs of numbers that formed the substrate for comparison between orderings were unstable and had inherent tendencies to move at specific accelerations. This means that the interference patterns between orderings have a component of variation that comes from the very fabric of the medium through which they interact. There is no doubt that this causes conjugate orderings to interact in highly unstable ways and causes endless variations in the diffusive and dissipative patterns by which this interaction occurs. Such interactions are in fact called Chaotic. Within an interaction between two orderings it is possible to fall into a state in which all possible orderings appear. When all possible orderings appear we call that state Chaos. This is different from merely random ordering that is still a specific and constrained ordering. Chaos is a disordering that has ordering within it interembedded to an infinite fractal depth.

The form of a dissipative system appears where there is a boundary with its

environment. The system has an active ordering principle that is introducing order from specific center(s) within the system. At the boundary the dissipative system is disordering the environment pouring entropy into it at some rate related to the rate at which it is itself being ordered. The ratio between these rates is normally such that the boundary of the dissipative system is expanding. But it is possible to have dissipative systems where the introduction of order is exactly matched with the entropy it is injecting into the environment. Such a system is homeostatic in the maintenance of its boundary. If the ratio tips over the other way then the environment is pouring more entropy into the dissipative system than the dissipative system is giving out. Such a system is being destroyed by the environment which is normally seen as a catastrophic collapse of the dissipative system. Order enters the dissipative system through a singularity within the system. The singularity within the dissipative system is a place were order appears from "*nowhere.*" This singularity is the dual of the boundary. It marks a boundary with a higher dimensional space through which ordering is pouring into the dissipative system. Normally we only hear about the outer boundary of the dissipative system and this inner boundary is ignored. But theoretically the outer boundary to the environment must be matched by an inner boundary to the environment. If we think of the dissipative system occurring in four dimensional space then understanding the existence of such a singularity is no problem. Normal spacetime is three real dimensions in space plus time. The dual of spacetime is timespace. Timespace was formulated by Minkowoski and is composed of three dimensions of time plus *nowhere*. *Nowhere* is an unreachable portion of four dimensional timespace considered to be decomposable into light cones with different inertial frames of reference. Minkowoski timespace considers the causality inherent in relativity theory. It posits that some portions of timespace are unreachable from other portions of timespace given specific inertial references frames.

 We apply this model to the dissipative system which is embedded in spacetime and can be looked at from the point of view of timespace. Notice that in timespace and spacetime there are four different continuities being brought into conjunction. What is continuous from one point of view becomes discontinuous from the other point of view. This is where the duality of spacetime and timespace arises from as theoretical viewpoints of the matrix from which they chiasmicly arise.   A dissipative system inscribes orders on the different illusory continuities within the matrix underlying the timespace and spacetime chiasm. Specifically it reorders the space continua based on a driver that operates in the time continuum. Here we are

assuming that order is generated by some algorithm. As has been pointed out by Goertzel and others the complexity of the algorithm is a good measure of the complexity of the order being imposed as a pattern. We differ from Goertzel in that we recognize a whole series of emergent ontological levels at which ordering may be taking place and do not reduce all patterning to the structural or primitive level beneath the level of forms or shapes. The algorithm that is ordering cannot be at the same level as the continuum being ordered. Let us take the example of cellular automata. When we see cellular automata we normally see a field of cells with colors representing their current state. The rules that lie behind all of these cells in the field are different from the field of states they operate upon. Where are they in relation to the field of colored cells representing the states of the automata? *Nowhere!* And this is made clear by the fact that there is normally one set of rules for the entire field of automata. In other words the rules are at a meta-level of some kind over the field of cells states. This meta-level in this case allows one rule set to cover all automata within the field. Within this set of rules there can be different ordering imperatives that are alternated between depending on the state of the automata. This allows cellular automata to emulate dissipative systems very well. We can see the imposition of order and the disordering of ranges of cells that lie on the border between different ordering imperatives. The the patterns of order imposition which then disorders the environment will give a definite perceptual boundary to the patterns in many cases. Or different centers of ordering imperative (that appear in the same rule set as different sets of related rules) may interfere with each other producing infinite varieties of chaotic patterns. In either case the boundary is only perceptible from a viewpoint raised out of the field of automata states itself, and the rules also occur in disjunction from the field of automata states. But rules and boundary are duals. Rules only change automata states because they are stimulated by some different situation among the neighboring automata. Thus the boundary that is seen perceptually only appears because each automata can be aware of its neighbors and react. This means the perceptual discontinuity is a function of the local continuity between automata. Correspondingly the rules must be sufficiently complex to contain internal cycles of states that will allow different orders to appear. Sometimes this internal differentiation of the rules can be very simple and still produce very complex behavior in the total field of automata. But just as the rules are ignorant of the specific context so the boundaries we see are not felt globally across the field of automata. So although there is a duality between boundary of the dissipative system with its environment and the boundary with the meta-level at the singularity these two may not be connected and may be caused by connections between things that are not immediately apparent. For instance the

boundary in fields of cellular automata are illusions that occur because of local awareness of neighbors and structures of rules. Those boundaries are not directly related to the rules but are in fact a side effect of the specific context of every automata in the entire field and the structure of the rules.

This simulation of a dissipative system by cellular automata is very informative because it shows how the ordering principle from no where is not something mystical but very concrete. It tells us that the rules must be at some meta-level or the same set cannot apply to all automata. It shows that the duality of the singularity within the system bounding it with nowhere is just as important as the boundary of the dissipative system with its environment. It shows us that the outer boundary may be an illusion and that local connectivity may be more significant than global patterning. And finally it shows that the perception of the continuity of the field of the dissipative system must be lifted out of the plane of that system just like the ordering principle must occur at a meta-level. Thus there is a chiasmic relation between viewpoints and meta-levels of ordering that appears in the dissipative system. A dissipative system may not know it is one thing. To it there might be just local interactions according to some ordering principle that because it is located nowhere applies everywhere and gives the automata a patterning it is not aware of itself.

We will call such systems Openly-Closed. They are different from Closed systems which are normally mechanical and Open systems that are aware of their environment and are in some way permeable. Instead Openly-Closed systems are closed to their environment externally but open to them internally through some meta-connection. For instance, the openly-closed system blindly pours entropy into the environment while it accepts order from nowhere internally that appears at a singularity within the system. Such systems are closed because they do not react to their environment except to disturb and disorder it. No information crosses the boundary to the environment from outside to inside. All transfers of information are from inside to outside in-forming the environment with a new pattern that is produced by the dissipative system. The system does however accept information flowing from nowhere with its boundaries. Those points of order production are called singularities and from them radiate ordered patterns that move out toward the boundary and interact with the environment to form the expanding boundary of anti-production. This system is blind in that it has no cognitive awareness of what it is doing internally or externally. It is accepting blindly programming from above and is carrying out that programming in such a way that increasingly disorders the

environment as it continues to order itself. We might think of such a system as "channeling" messages from a higher source which causes increased order inside the boundary and increased disorder outside the boundary in the environment.

Dissipative systems are also complicated as well because they have another important aspect that is usually not noted. There is always a principle of symmetry operating in any dissipative system. In this case it is the symmetry between rules within the set of rules that define the dissipative system. The disorder that appears are from broken symmetry between the rules that are for the most part symmetrical. This is why one pattern has a slight advantage over the other. But the rules need to be symmetrical to a great degree to allow both kinds of order to appear in the field of the automata. This means that a particular automata can transition in and out of an ordering regime but it tends to transition one way more than the other in certain contexts. For instance, certain rules sets will start with a random pattern of states in the automata and will transform it into some kind of global order. Others need a specific ordered patterning to the field of automata states in order to produce their effects. Without an ordered patterning of input states it produces disorder or no order (lack of order). Rules cause transitions based on the states of neighbors and the self state. But transitions need to be bi-directional predominantly otherwise the ordering of the field of automata will remain "uninteresting." It is only when there is symmetry with some degree of asymmetry that "interesting" interference patterns occur because then individual cells will transition back and forth between states that are part of one order or the other order or are disordered in relation to the two orders many times before settling down into some stable set cycle of states that predominate within the dissipative system as opposed to its boundary. Thus symmetry of rules and a "pinch" of asymmetry are essential to getting complex and interesting patterns to occur at the system boundary with its environment. Singularities are where ordered patterns appear at specific spots within the system. From them radiate patternings of order. They signify a boundary with the *Nowhere* that house the universal rules. But within the rules are symmetries that allow transformations between ordering regimes and some degree of built in asymmetry that allows the system to be dissipative instead of static or cyclical in some uninteresting way. This relation between singularities that pour forth order and symmetries that allow asymmetries to be seen will become very important as this essay unfolds.

The dissipative system unfolds its order and expands its boundaries in space acting neg-entropically in time. If we reverse the time arrow we get the collapse of the

dissipative system instead. But if we switch to looking at it from the perspective of timespace we see that each order has its causal domain which it effects and that there are regions overlapping with the other order that are not effected by any causality from the one. These envelopes of causality overlap to create areas which are in both. Or there may be areas that are not ordered by any ordering principle. These envelopes of causality are equivalent to the light cones in Minkowoski spacetime. What is interesting is that ordering principles act independently as subsets of the rules list. They act locally to produce global patterns as side effects. Part of this structure is the symmetry of cellular automata nodes. They all have the same structure and see the same neighbors and are indistinguishable from each other. This symmetry is the dual of the symmetry of operations embedded in the rules. The independence of the nodes is opposite the independence of the individual rules. The interaction of the rules acting together to form cyclical state spaces is the opposite of the interaction of the nodes with their neighbors. The symmetry of the operations in the rules is opposite the symmetry of the indistinguishable nodes. The artifacts of boundaries between dissipative systems or dissipative systems and their environment is opposite to the artifacts of the singularities from which patterns arise seemingly from nowhere within the system. All these dualities working together produce the appearance of ordering principles which have their separate domains and interact at boundaries or interact with passive environments. These envelopes of causality appear when we take the timespace perspective on the dissipative system rather than the spacetime perspective. The spacetime perspective sees only the pseudo field of connected cellular automata as an illusory continuity advancing in time as a dissipative system. The timespace perspective sees instead the causal envelopes of the ordering principles and their interaction which can occur because of slight asymmetries in the sub-sets of rules that define the ordering principles cyclical state machines.

One final point of importance about the dissipative system is that it has a form similar to the mobius strip which has one surface and one edge globally but appears to have two edges and two surfaces locally. This analogy of the dissipative system and the mobius strip is very important. It shows us that the single boundary of the system uses the freedom of a higher dimensional space to twist back on itself to produce a seeming paradox of difference between local and global configuration. In the example of the dissipative system we are referring to the energy flows in which order is created at the singularity flows out to the boundary which is expanding and crosses that boundary as entropy disordering the environment. The

environment in turn influences the dissipative system multidimensionally at a meta-level producing the order appearing at the singularity within the dissipative system. This energy flow across internal and external boundaries of the dissipative system back through a higher dimensionality into the dissipative system again is like an Escher waterfall which feeds itself. We see how this can occur if we say that order is conserved. If order is conserved then the ordering of the dissipative system internally must be balanced by entropy inwardly. That means that the disordered environment needs to produce ordering within the dissipative system to make up for its loss of order outside so there is a direct connection from the global environment back on the dissipative system functioning multidimensionally as the entropy outside is turned into new order inside. But we know that order is not conserved so that this loop is not realized in most cases. In fact this loop can only actually be realized if it is closed by the functioning of another loop which is its dual opposite. However, it is important to realize that every dissipative system has the possibility of realizing such a path where the global environment effects the dissipative system from the inside instead of the outside. We call this presence of the outside inside an oracle. In other words the structural system has incommensurate singularities within it that appear in the margins between the overlapping viewpoints applied to it forming blindspots. These blind spots occur at the point where singularities appear within the flawed structure of the system. At these points higher dimensional entries from the outside without crossing the outer boundary appear. These oracular points may be seen as windows out on the whole of the environment. We see this in cellular automata. The singularities where order is produced show us how the rules impinge on the specific field of cellular automata given a specific set of states associated with each automata in the field. The rules are global the structure of the field where each automata sees eight neighbors is global and these global aspects of the environment is impinging upon this specific node in the field to produce an ordering that does not appear elsewhere or only a few other places within the interior of the dissipative system. A hidden aspect of the global environment is seen at the singularity where this possibility is recognized as a unique coordination of rules and states of the automata field.

 The oracle is a word that was chosen also to describe the next higher level construct above a turing machine. Turing oracles are universal turing machines that define the limits of computability ever more finely. The boundary between the computable and the non computable is not clear cut. Many times we might need multiple turing machines working together to define that boundary to some degree of resolution. We are never sure when the non-computable will intrude on our

computations and simulations of systems. Turing oracles answer the question whether a specific computation is indeed computable. They give a meta-source's answer within the process or computation as to whether computation is feasible. Through the idea of the oracle we realize that we do not always know whether a given operation is computable even in the midst of trying to compute it. Intrusions of non-computability are flaws in our computing structures and we call them defects or errors. It is well recognized that all software programs except for the very simplest that are "proven correct" have hidden errors that may or may not manifest during execution causing faults. You never know how many defects a program still has or when they will appear due to a peculiar combination of circumstances. But when they appear they are manifest as flaws that interrupt the computability of the software program. When a flaw appears suddenly one discovers something about the environment of the program that was not known before. Thus flaws are windows on aspects of the global environment that give us more information than we had before. Similarly if something cannot be computed because it takes too long or is theoretically impossible to compute like halting this tells us something indirectly about the nature of the environment which has an aspect is too complex to simulate. We may use turing oracles in order to refine our definition of this boundary between what is computable and what is not but ultimately this boundary always exists within the dissipative system. For instance if for some reason the dissipative was sophisticated enough to need to know the shortest path around all its nodes so that it required some knowledge of the answer to the Traveling Salesman program then only approximations will be possible and the ultimate answer will not be available within the dissipative system. In this case there would be a non-computable flaw within the dissipative system that is approached via estimations. So non-computability may be built into the very fabric of the operation of the dissipative system for which it compensates. These non-computable approximated quantities are flaws within the computational fabric of the dissipative system. They do not have to be errors but may instead be merely non-computable values that have to be arrived at heuristically. Turing oracles approximate these singularities of non-computability closer and closer in order to give an arbitrarily fine definition to computability. In this way we see that even the turing machine has a special form at the dissipative level which is used to delimit computability. And that form of the turing machine may be used to locate the flaws in the fabric of the computability. These occur either because the software program has errors in which case the oracle may merely be a test program or if the flaw is inherently non-computable in itself then the oracle might just be used to get a better definition on the point where non-computability appears so that an estimate may be

made by some other means.

6. Autopoietic Systems

 Autopoietic systems hold four strands of ordered illusory continuity in conjunction simultaneously.   This is composed by combining additively two dissipative systems. The mathematical threshold at which the theory of such a system is poised is the same as that of the quaternion and its associated Clifford Algebras. The fact that an autopoietic system is actually two dissipative systems "glued" together is a new conception of this relatively new theoretical construction that attempts to define life. Autopoiesis means self-producing. It refers to the ability of "living" machines to organize themselves. It was first posited as a theory by two biologists Maturana and Varela. This theory has some counterintuitive aspects that we will not dwell on here. Our point is that the theory of autopoietic systems and quaternions are at the same threshold of complexity and that autopoietic theory should be modeled on the structure of quaternions in order to best approximate the actual structure of living/cognitive systems.

 We can see this best if we first realize that Autopoietic systems allow the order/ energy loop of dissipative systems to be closed. This is done by making one dissipative system the channel for the other. This is like taking two mobius strips and "gluing" them together. We know that this form is the pentahedron in four dimensional space (the analog of the three dimensional tetrahedron but with five points, ten lines, ten sides and forming five tetrahedrons). In our case though we shall instead imagine that we have one mobius strip expressed as a medium in which solitons are moving and the other mobius strip is expressed as a mobius strip. In this model the solitons are flowing along the trough of the mobius strip. To imagine this it is necessary to see the mobius strip bowed to form a trough and the bowing moves with the soliton forming a transverse solitary wave moving around the mobius strip. Or conversely one can see the wave as moving through the medium of the strip that exists as the displacement between the edge and surface. The mobius strip is closed but the trough is reused at each point by the fact there is only one boundary and one surface. What is outside from one point of view is inside from the other point of view in relation to the trough. So now energy is not just flowing and transforming but is held in check by the presence of the other mobius strip that acts as a channeler for the loop of energy conserving its order. Because of this the autopoietic system can act as a perpetual motion machine. The conservation of its order is its own self-production or self-organization. Perpetual

motion is possible in four dimensional space even though it is denied in three dimensional space. Our world is four dimensional. But we get two views of this four dimensionality as either spacetime or timespace. This is why Maturana and Varela say that a autopoietic unity made up of nodes must be embodied in space and may not just be theoretical constructs. Its self regulation based on an internalized hypercycle (like the rules of the cellular automata) appears to occur within spatial boundaries and maintains the structure of the autopoietic system homeostatically over time. But from a timespace viewpoint we can say that within every autopoietic system there are two ordering principles that are interacting. These take the form of dissipative systems that are interacting to produce the self-organizing structure of the autopoietic system between them. Effectively the autopoietic system appears in the interface between these two interacting dissipative regimes. We can think of them as connecting the disorder of one dissipative system to the ordering of the other and vice versa. The two dissipative systems symbiotically feed off each other. They do so in such a way that organization is conserved. This is like a perpetual motion machine made up of two Escher waterfalls intertwined. Together they each have a twist that fits together with the twist in the other to produce a perfect unity. One waterfall is the energy of the system moving through the inner and outer boundaries. On the outside the other Escher waterfall takes that energy up to the meta-level and channels it back to the oracle at the center of the other dissipative system. Each Escher waterfall helps the other so that neither lose energy and they constantly compensate for each other in such a way that they channel each other. One waterfall appears as soliton waves moving thorough the mobius strip channel of the other. From one point of view one is the non-entropic wave formation and the other is the channel but from the other point of view the situation is reversed. These fused dynamic mobius strips may be seen as a Kleinian bottle. This is to say the pair acting together is closed as autopoietic systems are posited to be.

This vision of autopoietic systems as interwoven pairs of dissipative systems is an important contribution to the understanding of these very special systems that give us machines that self-organize and imitate the phenomenon of life. Such systems are living/cognitive. This means that they combine artificial life and artificial intelligence together into a unity. We can understand this if we refer to Geortzel's concept of the Perceptual-Cognitive loop. We see such a loop not as an algorithmic loop within the brain but can be seen in terms of the static mobius trough through which the solitons move. This loop is perceptual from one side locally and cognitive on the other side locally. Globally perception and cognition are the same thing. The opposite loop Goertzel recognizes as having to do with the movement of

materials from short term to long term memory and vice versa. Instead I would talk about a recognition/memory loop. On one side it contains memories and on the other side it contains recognitions. Globally what you can recognize is the same as what you can remember. Recognition occurs within the field of short term memory. In this sense we return to Plato's dictum that learning is just remembering. This is to say that the transition between recognition and memory is reversible similar to the reversibility of percepts and concept. As Husserl says there is no percept without some conceptual aspect and no concept without some perceptual component. This is why Husserl defines noema and noesis as differing degrees of combination of intentionality and the hyle or matter of consciousness (i.e. pure quality).. Similarly there is a reversibility between Memory and what is learned or recognized. Something cannot be memorized without being recognized. Similarly something cannot be recognized unless there is some memory to base a recognition on. This is true of even novel things. To see them at all we must have some framework for understanding them at least partially even if that framework is ultimately wrong. Without at least such an inadequate framework to begin with we would se nothing instead of something. As Feyerabend says perceptions are forgotten theories.

Thus we can see the psychological system, such as Goertzel attempts to define as a combination of two dissipative systems one composed locally of perception and cognition but which identifies these globally and the other composed locally of recognition and memory but which identifies these globally. Together these two interoperate so one forms the basis of the energetic flow of the other. We can see either as static and the other as dynamic. Thus we can see perception/cognition operating on the basis of memory/recognition as Goertzel does or we can see memory/recognition operating on the basis of perception/cognition. In the latter case instead of an algorithm like loop of perception moving toward cognition and back out again we see that perception/cognition channels memory/recognition. This is much like the insight of Powers that behavior controls perception as well as the reverse. Here perception and cognition control memory and recognition. This difference in viewpoint is similar to the difference with the framing of the relation between what Goertzel calls the dual networks. He sees the memory related network as a heterarchy and he sees the control processing network as related to hierarchy. I have noticed that to make his theory social instead of psychological these two roles of the network in relation to heter- and hier-archy must be switched. Agency is a heterarchy and related to control while Functionality is a hierarchy and related to association. Here we might say that Wm. T. Power's insight that

behavior controls perception allows us to relate the perceptual/cognitive loop to heterarchical agency while the memory/recognition loop is related to hierarchical functionality. The heterarchical agency forms the distributed parallel field of the actors that make up the society of the mind that handles perception and cognition. The hierarchical functionality forms the branching tree of intentionality which allows memory and recognition to occur and reinforce each other. Memory means organizing information in this tree while recognition means using the information in the tree to bring it to bear on a perception or cognition. This operates like a B++ tree algorithm for storing data. Certain functions places information in the tree for efficient recovery. Other functions allow the information to be retrieved given a key field. Kinds of work are organizations of memories where the memory entails certain kinds of actions. Thus memories control actions similar to the way perceptions do. A recognition may call out a completely autonomous action group or a habit. Goertzel relates the concept of habit to pattern. He gives pattern a meaning somewhat like an ideational gloss, it is a coherent abstraction from a more complex pattern. However, he has not explained how a pattern can be a habit. I would venture to say that action lies between the perceptual/cognitive loop and the recognition/memory loop. Actions can be guided and controlled by either loop. When one loop is active the other is passive. If the action is controlled by the perceptual/cognitive loop then it is related to heterarchical agency and autonomy *and* if it is controlled by the memory/recognition loop then it is related to hierarchical functionality and intentionality. So any specific action may be thought out and related to behavior that control perceptions (or the reverse) or it may be based on recognitions that call up memories as habits. In the first case we can explain the production of behavior by the functioning of an algorithm that does calculations producing patterns. In the second case we explain the production of the behavior by the habits that are pre-stored reactions. The pre-stored action sequences are not calculated but instead are precomputed and just read from memory and enacted when the circumstance is recognized. Of course the second means of accessing is much quicker and effective at producing split second responses but such responses are somewhat blind in that once the execution is started there is no guiding them nor making calculations along the way. Thus what appears as an algorithmically generated pattern from the perceptual/cognitive loop is a direct reading from memory of a habit from the point of view of the recognition/ memory loop. Of course since the two mobius strips combine to make up a Kleinian bottle there is a global Sameness to the two loops as well.

From this insight we move toward the question of what is non-dual action.

perception, and thought. We notice that we must add to Loy's triad also non-dual memory and non-dual recognition. Re-cognition is neither perception nor cognition. Both of these assume distance from the object and the ability to manipulate it either physically or mentally. Recognition is pattern matching that is faster than ether perception or cognition and does not assume distance. One sees something from the corner of the eye and reacts -- later one realizes that it must have been a bug flying from out of nowhere too close to the eye. One's body reacts and that reaction may be to call up memories. Or the reaction may be to store a memory of something or someone for later reference. Likewise there is no distance from memories except temporal distance. The perceptual/cognitive loop can be seen to project spacetime while the recognition-memory loop projects timespace. When a memory is activated then we see it impinging on our consciousness in an unmediated way from inside. Non-dual recognition means to recognize something as the same despite differences. Non-dual memory means recollect a primal scene. A non-dual memory is a memory of a scene that is always the same. One recognizes the primal scene as the same with itself over and over again. The primal scene covers over yet indicates the always already lost origin. Recognition is the returning to the same and finding it new and the same again and again where difference and sameness intermingle. These two non-dual resources within us unite together to give us what Nietzsche called eternal return of the same.

 Similarly we can say that the perceptual and cognitive loop is the manifestation of the will to power. It is our means of initiating distance in the world and it is through that distance that we control and manipulate things in the world that we have first separated ourselves from. Non-dual perception is one that does not separate the object from the process of perception itself. Looking into the distance if we unfocus and see the whole scene then we have achieved non-dual perception. Similarly non-dual cognition is one in which what is cognized is no different from the process of cognition. Thus a single thought held in awareness through contemplation gives us non-dual cognition. In both cases we revel in the process of perception not what is seen and in the process of cognition not what is thought. These together can be related to consciousness without object. When consciousness has no object then it takes its own states as its object. A free flowing field of consciousness is produced which does not attach itself to any thought or perception. Non-dual thought and perception is related to this flowing field of consciousness which is epitimized by optimal flow experience. When this occurs the will to power is stopped dead in its tracks. Normally this would entail a switch to a recognition of the remembered same. This is why Nietzsche speaks of these two

principle as being opposites.

However, we can also see that between non-dual perception/cognition which exhibits optimal flow and non-dual memory/recognition that exhibits return of the same there is non-dual action. Action is the interference pattern produced between the two dissipative systems or dual networks. Normally one network or the other is the cause of action. However when optional flow is connected to return of the same then one enters into the realm of eternity. This means that when optimal flow centers around the continual recognition of the same then what appears to be a perpetual motion machine is created in consciousness which causes action to be produced from a single center. Action is unified when its organizing principles are organized into a single coherent source. This is the realization of the autopoietic system within the psychological realm. This is an altered state of consciousness which has been called "Sat Chit Ananda" in the Hindu tradition. We associate it with bliss and perfection of Being. It produces a completely unified human being with coherent actions that revolve around the Same within a consciousness of optimal flow. This has been a state that many traditions have attempted to achieve by many different spiritual disciplines. This state is our reference for understanding states of lesser coherence. It is not possible to build a model of consciousness that does not take into account more coherent states and expect to find them there when we finish. Instead we must remember that it is the autopoietic system that is the fundamental model of the cognitive/living. Living implies suffering and only that which remembers can suffer so life includes within it an implicit reference to memory. Thus the cognitive/living system must be equivalent to the combination of the perceptual/cognitive loop and the recognition/memory loops into a single autopoietic unity.

That unity is poised exactly on the threshold of complexity of the quaternion system. We speculate that like the mandelbrot set (M1) that appears at the level of the complex numbers there is a meta-mandelbrot set (M2) at the level of the quaternion, and again another meta-meta-mandelbrot set (M3) at the level of the octave. These mandelbrot sets of higher dimension supply even more complex lines of flight at each progressive level of organization specifying micro chaotic instabilities and tendencies or propensities that mark the interaction of the pairs of dissipative systems that interface to produce an autopoietic system. So even though these systems with their strange twists are very regular there is embedded in the very fabric of the vectors that make them up an infinitely granular set of chaotic propensities that make it so that the complexity of the possible interactions are

infinite. This variation due to contrary propensities is woven directly into the fabric of the spacetime continuum. This is why Davidson discovers infinite fake R4 topologies. The very substance of spacetime/timespace matrix is chaotic at its center. The quaternion and its Clifford algebras give the intertransformability that is necessary for the illusion of continuity. At this level this intertransformability is limited by the absence of the commutative property. Going one direction does not automatically allow you to reverse and go the opposite direction to get back to where you started. However, all other aspects of the system that give intertransformability are preserved at this new level. The loss of the commutative property opens up a chasm. New routes need to be explored to allow one to return to ones starting position in case reversal or inversion does not work. In fact because the quaternion is globally connected there are round about ways back to ones starting point through the application of multiple transformations. But the chasm of non-commutativeness allows the two dissipative systems room to maneuver with respect to each other maintaining their integrity while still interacting. The split between the dissipative systems because of non-commutativeness opens up more asymmetries in the heart of the autopoietic system and it is out of those action unfolds. Actions are the manifestation of asymmetries of energies in the world. Actions come out of the heart of the autopoietic system. That heart is a whole network of flaws that work together to form the network of the autopoietic system itself. In the dissipative system the flaws were random and did not work together. In the autopoietic system the flaws (oracles) form a network and work together to channel the oracular information from nowhere into an organization that is the same, eternally returning to the same, its own structure appears as a homeostatically maintained variable of the autopoietic system. The autopoietic system remembers its own structure and recognizes itself. It is through self-memory and self-recognition that the autopoietic system is able to maintain itself. But the autopoietic system also maintains its boundaries internally and externally. Perception relates to the monitoring of the boundary. The movement of the boundary which is different is a perception. These differences accumulate into differences that make a difference. Those differences that make a difference are processed by cognition. Cognition is merely the ability to make and transform abstractions. Guilford gives a morphology of the possible transformations by cognition that are the constituents of intelligence. Abstractions are subsets of the patterns of perception which are significant. We call these abstractions glosses because they leave out a lot of detail and present just the bare bones for manipulation by cognitive transformations. But both cognition and perception imply there is an illusory continuity that these perceptual and abstract differences are seen on the background of. In fact we can

see that perception and cognition are mostly about the maintenance of background illusory continuity and only as a side effect about the differences that make a difference and their significations. Thus the autopoietic system has an imperative to maintain its boundary and the perceptual cognitive loop is about maintaining that illusion of the continuity of that boundary. What appears projected on that boundary (either the inward one or the outward one) is of less importance. However these projections are moved by the perturbations from the environment and so give some indication of the relation of the environment to the autopoietic system. We call the relation to the inner boundary mind and the relation to the outer boundary body. Perception and Cognition as has been said are two sides of the same coin. Both concern differences that make a difference. One concerns differences that make a difference with regard to significations that arise at the inner boundary and the other differences that make a difference with regard to perceptions or perturbations in the outer boundary. So we see that there is a direct relation between the two loops and the fundamental imperatives of the autopoietic system. The autopoietic system maintains itself as itself by remembering and recognizing itself. The autopoietic system maintains its boundary inwardly and outwardly and finds projected upon that illusory continuity differences that it must continually correct to maintain itself as different from the external environment and the meta-environment.

  Action issues from the heart of the autopoietic system. All living things have behaviors. This is because it is the interference region between the two dissipative systems and arises out of the asymmetries that occur because of commutativeness property at the quaternion level. The actions continuously change the relation of the boundary to the environment and also continuously change the arrangement of the nodes (flaws) in the autopoietic network. Action is external and internal and through action manifestation is maintained. Constant erratic movement is necessary to keep things in manifestation. The autopoietic system produces this constant erratic movement so it can see itself. Making itself visible makes it visible to others as something living not dead and it makes other things visible to it by allowing the perceptual apparatuses to work. Thus action makes perception possible and perception guides action and then again action controls what is seen by the perceptual apparatus. So there is a continuous feedback between the organism and the environment where one effects the other which in turn effects it so that in the end you cannot say which started it. This means there is dependent co-arising between the organism and the environment. "Environment" is the environment OF some organism. There is mutual co-dependence and synergy relating the organism

and its environment.   However, it is important to realize that action unfolds naturally out of the autopoietic system (A point not usually made) and that it is through action that manifestation and presencing are made to occur.   The autopoietic system is at the level of complexity where Being first appears. Being is the dynamic of manifestation and presencing. Here it is undifferentiated Being but it exists and needs to be taken into account in our ontology of autopoietic systems. Autopoietic systems project their own being by making it possible for other things to manifest to it and for itself to manifest to other things. Undifferentiated Being issues with action from the heart of the Autopoietic system and it appears as the interference and cooperation between the two dissipative halves plus the asymmetries that appear at this level because commutative properties do not exist giving rise to special asymmetries that make presencing possible. Presencing is the manifestation of asymmetries. This is the stuff of consciousness. Everything that is symmetrical vanishes and are not manifest even if oppressively there somewhere we cannot see them. Actions attempt to compensate for these asymmetries that appear as the stuff of consciousness on the top of the invisible symmetries of everything that does not appear.

 A point that needs to be made strongly is that in the Autopoietic system the two dissipative systems are balanced against one another. If the dissipative system is in balance then it is not dissipative it is only dissipative if it is out of balance with its environment or other systems it is reordering. But for the autopoietic system there is a balance between the environment and the dissipative system or between two dissipative systems. Thus we move from the lack of balance where balance means death to a level at which dynamic balance becomes possible. Dynamic balance opens up a horizon of presencing within the living/cognitive system.   This is possible because in this special case the disordering from one dissipative system becomes the internal ordering of the other system and vice versa.   The two dissipative systems form a symbiotic mutually interdependent relationship. They in effect become one supra-system.   But that supra-system comes about by the addition of two dissipative systems exits as long as they are held in conjunction.

  We can also understand the autopoietic systems as universal turing machines. Each node in the universal turing machine is a turing machine with a special purpose. Where at the dissipative system level the question is one of computability for which the turing oracles give an answer at that level we can just build up sets of turing machines to define any computability problem. It is not till we get to the level of the quaternion/autopoietic system that we need the Universality which

allows any turing machine to be read from tape and executed. These individual turing machines simulate the nodes of the autopoietic system. They produce patterns and contain algorithms necessary to create different kinds of orders within the system. The execution of these are controlled by the meta-program of the autopoietic hypercyclical ring. Autopoietic systems are made up of diverse ordering principles that interact. Unlike the dissipative system that only has one ordering principle the autopoietic system may contain many ordering principles. These ordering principles inhabit the space between the two dissipative systems that make up the autopoietic system. There is a field of asymmetries and actions that open up from within the autopoietic system. In this field the ordering principles appear in a constellation. They undertake actions of ordering and appear due to the clustering of asymmetries. We can simulate them with algorithms. These algorithms are read from the tape of the autopoietic system and executed by the nodes. Each nodes acts as an independent agent and does different functions. It is through their social interaction that it is decided which function to perform when. This is generally also controlled by the hypercycle of the autopoietic ring. However the ring is not in complete control since there is a social aspect to the interaction of the nodes. If the autopoietic system was not a universal turing machine then it could not perform this execution of multiple programs and thus could not display the multiple ordering principles it needs to structure itself. What is the tape of the autopoietic system? -- clearly its memory. What is the processing unity of the autopoietic system? -- clearly its cognitive function. The autopoietic system must be able to read from its memory and execute. Nodes are points of memory and points of cognitive processing. Thus we have a distributed parallel processor which operates under a meta-program but that meta-program allows social interaction to ameliorate its control. Why is this? Because of Ashby's law. The meta-program cannot know everything so it delegates control to the nodes who react based on context given general instructions. The control allows for the quaternions in the neighborhood to interact and determine precise functioning of individual agents. In this way both global and local control is blended to produce the actual action of the autopoietic system in any given circumstance. Autopoietic systems are not completely determined nor are they completely undetermined. They may operate in a teleonomic environment with other autopoietic systems but individual autopoietic systems are homeostatic. However because each node is in slightly different context and it must operate appropriately to its context there is a fuzzification of control by social interaction that modifies the program of the hypercycle of the autopoietic ring. In other words if the hypercycle says do X but all the local nodes say do Y then a global-local negotiation will occur with a weighting toward the

local answer. In this way the autopoietic system controls from the bottom with guidelines from the top in conformance with Ashby's law.

Another point to be stressed is that the autopoietic system occurs because four illusory continuities are held in conjunction. Two pairs form dissipative systems and all four together form the autopoietic system. The dissipative systems are like mobius strips or Escher waterfalls and when you combine them they become a Kleinian bottle which is an emergent whole form that is produced by merely holding the four illusory continuities in conjunction expecting intertransformability. Intertransformability is weakened in this conjunction of four streams of illusory continuity by the absence of the commutative property. This causes us to have to go through extra steps to reverse transformations. The addition of these extra steps are seen as Actions and they occur because of asymmetries in transformations. These discontinuities in intertransformability lead us to the properties that a quaternion/autopoietic system has over a complex/dissipative system. There is in such a system a blockage to intertransformability that cause us to do extra action and creates system behavior. It also produces both perception and recognition. What is seen by the autopoietic system is due to the production of asymmetries. It is only if asymmetries are produced that anything can be seen. That thing to be perceived or recognized only appears because it initiates the production of asymmetries. But asymmetries can be handled by being transformed by the autopoietic system itself. The main work of the autopoietic system is to maintain itself. But it must maintain itself in an environment. Thus the perturbations of the environment and internal perturbations are seen as asymmetries. These asymmetries are processed by the autopoietic system itself through transformations which mark the difference between a transformation and the path that must be executed to bring about a reversal (due to lack of commutativity). Such a difference is continually being produced as the internal and external asymmetries are being processed by the system. Consider that the purpose of the autopoietic system is to maintain its own structure as an equilibrium. Then for such a system the difference between transforms and their reversals will be crucial and will specify the structure of the system that must be in orbits around its structural optima. Any perturbation in one direction must be matched by some push back from the opposite direction. So the autopoietic system must strive to maintain dynamic balance through the exercise of actions that are pushes back countering deformations initiated from the inside or outside. This constant countering must be based on the distance needed to reverse transformations given the lack of the commutative property. A perturbation occurs. The transformation that could have caused that effect is reversed but the path of

reversal is longer than the path of initial deformation or transformation so the autopoietic system cycles back toward equilibrium passing through a series of intermediate states. The autopoietic system has a perception due to the occurrence of the asymmetries and it has actions that are perceptible because simple reversal of a transformation is not possible. Thus an autopoietic system perceives or recognizes and it processes cognitively or it remembers. The difference between these two is which dissipative system in enacted to deal with the perturbation. If the perturbation is from the outside then the dissipative system that deals with it will probably be perceptual/cognitive. If the perturbation is from the inside then the dissipative system that deals with it will probably be recognition/memory. In other words such a system is set up to remember its own structure and recognize it. To recognize itself it needs to produce asymmetries and then process these. That processing is called memory which manages the difference between the primal scene of the systems structure and what is perceived to be the case. The realignment is an automatic action in most cases when something is recognized to be out of kilter then an automatic action is called up to rebalance things. This action is like a program read directly from memory and executed. If a perturbation comes from the outside then distance is necessary between the input of the asymmetries and the calling up of the action response. This distance gives us the fundamental difference between perception/cognition and recognition/memory. The production of distance creates the difference between self and other. Actions are now external not internal and effects must be sensed through outer perceptive organs. What is interesting is that the distance that is created and projected on the world is the inner distance that flows from the multiple asymmetries within consciousness. These are the very asymmetries that cause memory to be dark and incomprehensible if considered globally even though any one memory might be vivid and bright. Each memory is stored as if on a separate disconnected spot and the network for accessing them is heterarchical. But perception gives us the illusion that we are looking out on a fully connected perceptual field. Cognition gives us the illusion that there are abstract glosses that connect the endless variety of things in the perceptual field. Perception gives us the illusion we can integrat4e any field into gestalts or meta-gestalts of showing and hiding displays. But the field is actually a combination of perceptual and cognitive continuity and the algebras apply to the cognitive aspect of the field. Thus beyond the eight simultaneous continuities that are combined by algebras the perceptual continuity is shallow. On the other hand recognition takes each case separately and accesses memory pinpointing images that might classify and make understandable based on experience of some phenomena. So you see exactly what is connected in one case is disconnected in

the other and exactly what is clear in the one case is obscure in the other. This is much like the difference between rules and field of automata states in the example of cellular automata. Thus the two dissipative systems bonded together to produce autopoietic behavior view the same field of asymmetries and counter-transformative actions in opposite ways. One sees it as the connected field of the observable external environment which is covered by glosses. The other sees it as the disconnected matrix of memories that are accessed by recognitions on a case by case basis. The entire field of memories are hidden and how recognition works is mysterious. Sometimes it gives results that are contrary to what might be expected. The point is that memory is not a passive receptacle of information but memory is a way of transforming images much like cognition is a way of transforming information through induction and deduction. Recognition also is not a straightforward reading of memory but accesses the transformed images via its own particular protocols that like perception can be distorted or can change the object in the process of recognition or perception. The field of asymmetries can be viewed in either of these ways by the two dissipative systems but that field and its associated actions are the major emergent aspect that the autopoietic system adds over the merely dissipative system. Through that field the autopoietic system interacts with its environment and itself albeit in a round about and self-serving way. Out of the midst of the autopoietic system arises the asymmetries that allow phenomena to manifest and the actions that allow the system to maintain its own structural equilibria.

Notice that the maintenance of equilibria by actions naturally lends itself to a description using group structures. In fact we can go further and say that arranged around the symmetry point of the autopoietic system are multiple thresholds of group operations by which the autopoietic system maintains itself. The asymmetries themselves differentiate the elements of groups and the transformations or counter transformations form the operations on those elements. To this we apply the concept of groups connected by higher logical typing. Thus groups are chained where different group structures cover the same set of elements. For instance, there are five groups of order eight or five groups of order twenty. These different groups are at different levels of logical typing in relation to each other. So if a change cannot be accomplished at one level of logical typing then we pursue that change at a different level. The groups of the same order covering the same asymmetrical elements form a ring that is a hyper-cycle with respect to the autopoietic system in question. In the hypercycle there is a control relation between different logical levels. So one transformation at one level may initiate an action

but the same transformation at another level may cause that same action to cease. In this way the autopoietic system can control itself and establish its cycling always back toward equilibrium given any perturbation within its scope of possible control. Now by this we see how autopoietic systems produce their control structures. That is by group structures linking asymmetries and actions. When these group structures are chained to create hyper-cycles where the different groups cover the same set of asymmetries then we have a a natural control system that will allow the necessary changes to cycle back to balance. For instance, one group might be fine for small perturbations but larger changes may need us to switch groups moving to a higher or lower logical type. But since the logical types themselves form a ring then the autopoietic system is always closed while still covering all the possible transformations necessary to continually move back to equilibrium. These hypercycles composed of groups are referred to as autopoietic rings. They are the control structures of autopoietic systems and are at a different level than the nodes of the autopoietic system itself which are made up of, or made visible by. the asymmetries that occur in the autopoietic system by virtue of the lack of commutative property in the interface between the two dissipative systems. The dissipative systems alone would not have any actions to base memory or cognition on NOR any asymmetries to base recognition or perception on. The autopoietic system makes itself visible to itself through these asymmetries -- and concomitantly it makes itself visible to the environment and things in the environment visible. It appears to itself as nodes that are used to self-produce itself. These nodes are the locuses of different organizing principles encompassed by the autopoietic system. The nodes have differential action and the role of the hypercycles is to activate and deactivate organizational nodes as necessary and in that way they act as organizing or ordering principles. Many different organizing principles acting together build and maintain the autopoietic system. . These bundles of asymmetry may be viewed as synergetic motifs that serve to generate patterns. Nodes are clusters of asymmetries and are seen based on their difference from other nodes that are bundles of other asymmetries. Autopoietic theory distinguishes between structure and organization. Structure is physical arrangement in spacetime of components whereas organization is functional interdependence between components. We can think of these nodes as being quaternions. This concept was first articulated by Ben Goertzel in private correspondence. If we view nodes as quaternions then an amazing aspect of autopoietic systems appears: their fine structure is the same as their global structure! In other words any particular node in an autopoietic system is nothing more than a juncture between two dissipative systems. The dissipative systems do not just interact globally but interacts locally at every point in the

autopoietic system. Every node is both a point in the recognition-memory loop and a point in the perception-cognitive loop. The dual networks are the ways that the autopoietic system has to index into itself. From one point of view the nodes form a rhizome and from the other viewpoint they are arborescent. If the arborescent viewpoint is projected on agency then you have a psychological model whereas if it is projected on functionality then you have a social model. Similarly if the rhizomatic viewpoint is projected on functionality you have a psychological model whereas if it is projected on agency you have a social model. The social and psychological are two aspects of the same thing and are intimately intertwined at each point in the autopoietic system. These internal quaternion nodes are the embodiment of the autopoietic system as recognizing and remembering itself while perceiving and processing information about the Other (or vice versa). These dual loops at every point produce actions that are controlled by hypercycles of the autopoietic ring at a meta-level that opens out within the system. The quaternion nodes of the autopoietic system themselves interact through the next level of conjunction at which the octave and Cayley algebras come into play. We cannot tell whether we are looking at autopoietic systems interacting with each other or nodes of a single autopoietic system because both appear exactly the same. Within the autopoietic system the nodes are quaternions interacting through social structures. Outside the autopoietic system it interacts with other autopoietic systems via the same reflexive structures of octaves. Autopoietic systems naturally fall into social modes of organization as do the nodes within an autopoietic system. For an autopoietic system the inside mirrors the outside and vice versa. This is a unique formation that can only occur in systems that take on this very special form. It is a mirroring like that which Lacan speaks of and Baudrillard borrows to talk of social production. In Lacan children realize themselves as themselves when they reach the mirror stage -- i.e. when they recognize themselves in a mirror. Similarly in social production there is a mirroring in which "the human species comes to consciousness in the imaginary. Production, labor, value, everything through which an objective world emerges and through which man recognizes himself objectively -- this is the imaginary. Here man has embarked on a continual deciphering of himself through his works, finalized by his shadow (his own end), reflected by this operational mirror, this sort of ideal of a productivist ego." [Baudrillard Mirror Of Production page 19]. The social mirroring and the psychological mirroring are themselves mirrors of each other so that we are lost in an infinite play of images in dual mirrors. This infinite play of images occurs within and without the autopoietic system. The images are created by the production of asymmetries and the production are the actions that create or

compensate for asymmetries. But every action and every perturbation calls for more action or engenders by feedback some new perturbation so that there is an endless production of variety from within the autopoietic system that reflects in the inward and outward mirroring infinitely. Since the autopoietic system is by definition a simulation of a perpetual motion machine this endless self mirroring and other mirroring creates a balance which is perfect between inward and outward. Until the spell is broken this mirroring of the social in the psychological and the psychological in the social is a built in feature of all self-producing systems.

7. Reflexive/Social Systems

In the last section we mentioned the key point which is that the autopoietic system is made up of nodes that are quaternions and that these quaternions interact socially via the next level of conjunction which is described by the octave hyper-hyper-complex numbers and their Cayley algebras. Groups of autopoietic systems looked at externally also interact at this level of complexity and with this form of intertransformability. Thus what goes on within and outside the autopoietic system is social and by definition reflexive. Reflexive here points to the mirroring that was mentioned in the last section. In sociology reflexivity has a special meaning of theories that do what they say. Many social theorists in the early seventies called for such theories but they were very difficult if not impossible to produce. They were theories that were self-aware and referred to themselves in a similar way to the Cartesian idea of thought thinking itself. I call this reflexion with an "x" to differentiate it from reflection with a "t" which means thought stopping to think completely. Stopping thinking and thought thinking itself are two extremes of thought. Reflexive thought is always paradoxical and leads to all kinds of conundrums which we can only get out of by cutting the Gordian knot through ceasing thought. Social systems are reflexive because in a social system as G.H. Mead and other symbolic interactionists have pointed out one reflects the other in our actions by taking account in advance his reactions to out proposed actions. In symbolic interaction one self is formed by its reflection in all the other selves of the society. Thus society is really only the infinite play of mirroring between selves. Likewise within the self there is only an infinite mirroring were what we mistake for ourselves is merely the sum of our interactions past and present with others. The reflexive is an illusion created as an excess by ideation. Both cognition and memory create glosses. These glosses or abstractions are the product by which ideation handles the endless variety of asymmetries produced by the autopoietic system. These glosses are the forms that appear in the dual mirroring of inside and

outside. They cover over and hide endless variations in content. They are the means by which the autopoietic system recognizes itself as itself. Without the glosses it would lose itself completely in the sea of endless variation. This means that autopoietic system must be able to recognize kind or essences and use them to connect between ideas and the noematic nuclei of phenomena. It is essences that appear out of the mirroring of inside and outside. They are the points of stability in the dual mirroring. If there were no essences then we would be completely lost in the sea of variation. But essences allow us to tell different kinds from each other and recognize similar kinds. Perceptions work with differences between kinds and recognition with similarities between kinds. Cognition creates similarities between different kinds building up abstractions to higher and higher levels. Memory produces differences between the same kinds that is why you can have the different memories of the same thing in different circumstances. Memory uses differences to store the context for a particular kind. Once recognition identifies the kind then memory shows all the different contexts it can operate within.

The octave holds eight streams of illusory continuity in conjunction simultaneously. It does this by converting the streams in pairs into dissipative systems and converting dissipative systems into autopoietic systems and producing a social matrix for the autopoietic systems. In the social matrix the autopoietic systems mirror each other. They establish a protocol which creates a symbolic exchange. At this level we have turing machines communicating across their mutually held tapes. Mutually held tapes are group memory. They also become communications channels between turing machines. Composed turing machines glued together by their tapes in this fashion become large turing machines. Thus the social milieu is merely a large universal turing machine with the behaviors of individuals being the algorithms that are executed. There is no difference between the inside of an autopoietic system and the clustering of many autopoietic systems together. In both cases the interaction of quaternions occurs via the octave level conjunction. This is like a meta-Klinean bottle composed of the two autopoietic Klinean bottles to create a single higher dimensional object. It is a single whole composed additively. We can think of these systems like perfect numbers which are produced by adding all their parts: $1+2+3=6$ or $1+2+3+4+5+6+7=28$. Similarly social systems are produced additively by holding in conjunction eight streams of illusory continuity. When you do this these streams automatically form four dissipative systems, two autopoietic system and one reflexive/social system. At each level there is some emergent phenomena that unfolds from the higher level conjunction.

The emergent phenomena that appears at the octave or social level is related to the property of intertransformabilty that fails at this level. The property that fails is associativeness: (AB)C = A(BC). What is fascinating is that it is the failure of the associative property in Cayley algebras that produces social phenomena. When the associative property fails we suddenly are hyper-aware of associations and this is what creates social phenomena. Social phenomena are asymmetries in associations of nodes or autopoietic systems. When the associative property holds we do not notice these phenomena. They only come to consciousness when we cannot count on associations being reversible. Only asymmetries are visible and it is the asymmetries in the social fabric that become visible at the level of dissipative autopoietic reflexive systems. We can no longer be certain that groupings are interchangeable so that different groupings may produce different results. These differences between groupings is what makes the social visible for the first time only at this level of complexity.

Another point worth mentioning is that both autopoietic systems produce asymmetries and actions out of themselves. These asymmetries and actions may overlap and this is what we call the social world. The shared projection space of visibility is what allows autopoietic systems in the social fabric to see each other and to see themselves as a group related to other groups. There are shared glosses and shared actions. As Durkheim said Kant's Categories (the ultimate abstractions) are socially produced. In this way it is autopoietic systems that get their ways of looking at the world from the social system not vice versa. Perception is first social perception. Cognition is first social cognition using socially constructed typologies. Recognition is first social recognition. Memory is first social memory. Thus the whole hierarchy of specialized systems is turned upside down. The autopoietic emerges out of the social. The dissipative emerges out of the autopoietic. The general systems arise out of the dissipative. The whole hierarchy must be inverted because it is the social that projects the world within which all the other kinds of systems appear. This is the paradox of the Anthropomorphic principle. We must be here for it to be seen therefore we condition everything we see from the building blocks of the universe through all the emergent levels up to and including ourselves. Autopoietic Sociology is the most general science including within itself all other sciences of phenomena that appear within the socially constructed world.

Another point is the interaction between the perceptual-cognitive loop and the recognition-memory loop. We have seen that one appears as the trough for the other converted to the dynamic of solitons. Thus one is frozen as a platform for

viewing the dynamic of the other or vice versa. We can go on to say that the relation between these two modes between solitons is the instantaton. In other words when an asymmetry appears in one soliton formation that comes from the other soliton formation it pops into existence like an instantaton. So asymmetries that appear out of the unconscious and must be orthogonal just pop into existence from the point of view of the perceptual cognitive loop. Likewise traumatic events are converted into instantatons that intrude into the recognition-memory loop. This recognition-memory loop plays tapes of past traumatic sequences over and over and can only be cured by metaphor work where the traumatic contents are ejected from the recognition-memory loop. Similarly besides ejection of foreign contents that imbalance the memory-recognition loop there is the opposite which is injection of content. For more on this see <u>The Fragmentation Of Being And The Path Beyond The Void</u> which explores the Therapy of David Grove and the use of Clean language to free the Recognition-Memory loop of foreign metaphors. When those traumatic memories intrude on the perceptual-cognitive loop it is as movies of the traumatic event which we play over and over for ourselves. Steven Briggs, a practitioner in Grove Hypnotherapy, says that the basis of Grove's technique is "*accessing*." We have called *accessing* here recognition. In other words there are two ways to get to memory. One way is via indexes into memories that use the cognitive resources. The other way to get to memories is to perform direct accessing of contents. In the later instance the conscious mind does not control what is seen. One has in effect stopped the perceptual-cognitive loop and given over to the dynamics of the recognition(accessing)-memory loop. Both loops when out of balance intrude on each other. There is unconscious material that appears in consciousness and is the ultimate basis for desiring machines and there is the movies from the unconscious that replay traumatic scenes sometimes distorted and warped into unrecognizable images. On the other hand traumas within the perceptual cognitive loop cause insertions of traumatic materials within memory so that every recognition falls into the same warped pattern and all memories recall the trauma in one way or another. This dynamic between the two loops that appear in our psychology as the right brain and left brain dichotomy have a complex interaction that needs more study. However, having the dual mobius strip model in which dynamics is modeled by turning one mobius strip into a soliton formation and that understands shifting between modes in terms of instantatons allows us to understand the relation between balance and imbalance and how the two mobius formations can effect each other by producing discontinuities in each other.

The asymmetries that appear within the socially shared space of perception-

cognition or recognition-memory allow us to first see each other and then later other things within the world. The actions that we share are social actions instead of individual actions. Just as the two dissipative systems differentiated themselves while remaining balanced in every octave conjunction the two autopoietic systems will differentiate. The octave conjunction can be thought of as a marriage. Marriage is the root of all society. In every society the male and female roles differentiate. This is because that they need to be different in order to recognize each other and to perceive each other and to think about each other and to remember each other. In other words marriage is a fundamental social bond that posits harmonious social relations between different kinds of the same kind.

Notice that at the autopoietic level we were saying that we needed essence perception of kinds to be able to find out way within the mirroring of reflexivity. Here we see that kinds of the same kind are needed at the level of the social in order to create harmony. That harmony is the interaction of two perpetual motion machines. It is not a maintenance of homeostasis of structure. It is instead heterodynamic because it is a continually changing balance between partners that are kinds of a kind like male and female. It is from this root harmony that the world is projected ecstatically. At the heart of the world is a home and the love between partners. The social phenomenology of love is needed to understand this experience. So much existential phenomenology concentrates on angst and the experience of desolation of the individual alone. This is because our culture has gone to extremes to separate individuals and create the illusory ideal of romantic love. When we speak of the phenomenology of love we do not mean romantic love that is self destroying. Instead we speak of the love that arises out of marriage that is sobered by the actual living with another human being instead of the attempt to obtain an unobtainable ideal. This more sober and realistic love for an actual human being that comes with knowing them for some long period of time is neglected in our culture despite its roots in our tradition like the love of Odysseus for Penelope. Normally this kind of love is ignored because it is not as exciting as adultery or the romantic love for the absent perfect one. However, all the variations are based on normal everyday marriages that have been the heart of every civilization since the beginning of time. We do not yet have a phenomenology of normal marriage and its sober tolerant love but we need it in order to really understand the human predicament. Because it is those normal marriages and the love that grows within them that are the root of the social fabric. In Greek the household is called the oikos. There is a constant tension between the household and the city that contains all the households. The city in Plato's <u>Laws</u> is the very image of the Autopoietic

system. Within the city are the nodes of the oikos. Here we see how each node within the autopoietic system is really a social autopoietic system. Each household is a social conjunction between two people in the social contract of marriage. They set up the full social fabric between them that encompasses their household. The city is made up of all these social nodes and forms a social autopoietic system. But since there is no difference between the outside and inside -- since both are social then we see that each household is really an autopoietic system that encompasses all the individuals in it as nodes. We can instead see each individual as dissipative systems within the autopoietic system. Similarly we can see each city as a dissipative system within the cluster of all the neighboring cities. Each city has its ordering principle and attempts to impose it on the other cities. Similarly within the household there is the dissipative system of the women's world in relation to the dissipative system of the men's world. Culturally in Ancient Greece and many other cultures these were very different worlds isolated in many ways from each other. The union of marriage bridged these two worlds. The treaties between cities bridged the gulf of competition between cities. So that we see that it is possible to take different viewpoints and see the marriage within the household as social contract from one point of view and as dissipative orders opposed to other orders form another point of view. Between these to extremes there is the autopoietic system itself that is the point of mirroring which is utterly social inside and out. Thus what happens within the household is the mirror of what happens inside the city and vice versa. What happens inside the individual is the mirror of what happens in their social milieu. Multiple levels of mirroring which are resolved by the union of kinds of a kind. The individual is born out of marriage and grows up in the household before entering the life of the city. The household is born out of the marriage of the owners of the household which is a social contract between other households setting up their children to inherit or begin their own households. The city is nothing but the sum total of its households that may have migrated from other cities. Plato says the best city wall is made up of the walls of the households that make it up. This is exactly the form of the autopoietic ring.

The essence of the social is emergence. Emergence is the arising of the totally new. This is the driver for the heterodynamic nature of the reflexive that projects the world ecstatically. It is G.H. Mead that realized that the social must be emergent. This is the interesting thing about the social. It only remains the same by constantly changing and that change can be either subtle and continuous or dramatic and revolutionary. That such a reflexive system will change is the only constant. The changes themselves will be unpredictable both in their magnitude and duration.

But in such a system change is constantly changing so that the structure being held homeostatically constant is continually changing. Each autopoietic system is holding on to its structure but they are constantly engaged in a meta-structure that is heterodynamic. That heterodynamic meta-structure is founded on the tendencies or propensities of the Meta-meta-mandelbrot set. Thus there is a chaotic basis that Deleuze and Guattari call schizophrenic. This merely refers to the wild and endless variety of production in such a system that never allows any time for rest from variety production. Deleuze and Guattari posit that the individual has no reality (at least psychologically) but that it is composed of desiring machines and embedded in the socius. We concur to the extent that we recognize the level of desiring machines as the nodes within an autopoietic system of the individual as organism. That organism is trapped within the mirroring on either side of the autopoietic system which is social in both cases. Thus the desiring machines interact at the semiotic level as social groups using reflexive structures and also the individuals in our lifeworlds also interact socially using reflexive structures. This dual sociality of desiring machines and autopoietic systems is called the socius. The socius is heterodynamic and continually emerging projecting the world as full of emergent things. Among those things are the social entities from which unfold all other objects. The word *Thing* originally meant a kind of social gathering and later came to mean any entity. Similarly the Social Thing antedates all other things in the world which are all socially constructed out of the fundamental social material which is propensities or tendencies that lie at the schizoid basis of all human groups and is the substance out of which the world is produced. Human groups produce endless variety in their worlds which are continuously changing either in small ways or big ways and it is these changes by epochs, epistemes, paradigms, theories, facts etc. that is the essence of the human being within the western worldview. The fabric is social inside or outside and the social fabric is founded in the posibillity of the harmony of marriage. That harmony is disrupted by a myriad forces within our projected world but the human marriage is the social contract upon which the world is founded which posits the possibility of harmony and which makes the world something other than the nihilistic war of the all against the all including war against oneself. Many times the world degenerates to something like that state. But within the madness there are always pockets of harmony which could not exist if harmony was not the always already lost origin of the world. Within the Indo-european tradition that primal harmony is always sacrificed in order to create the real world. The the ideal of harmony is approached again and again through temporal sacrifices. The temporal sacrifices are the continual changes of epoch, episteme, or paradigm within the world by which the original harmony is

approximated again and again. The social encompasses the emergent and the harmonious in a single unity of kinds of a kind. The social is the basis of the world which is founded on human love within marriage. Social phenomenology centering on the phenomenology of mundane love is the human basis of autopoietic sociology that seeks out and elucidates autopoietic systems that mirror the social internally and externally. The other basis of autopoietic sociology is an understanding of computational sociology which understands that human society is computable via turing machines sharing tapes and using them as communication channels. Distributed artificial intelligence and artificial life eco-systems address this problem but it can only really be simulated in Artificial Intersubjectivity (A-IS) which is based on an understanding of how autopoietic systems as universal turing machines set up symbolic exchange to produce social harmony and how these systems automatically produce emergent effects.

When we look at the algebras we find that what is left in tact after the stripping away of properties (commutative and associative) we have just gone through as we ascended to the social level are the transitive [A=C A=B=C], reflexive [A=A], symmetry [A=B, B=A], and identity [A+0=A or A*1=A or A-A=0 or A*1/A=1] properties. These properties are the core of all algebras. The transitive property basically says that there are multiple paths to the same place within the set of elements covered by the algebra. The reflexive property says that you can verify that something is itself. This is to say it can be recognized as itself at any time. The symmetry property gives us equality itself. The identities relate to how operations take something and its opposite and produce the identity element or how the identity element and another element always give you the other element. Normal algebras are rings with two operations that both have different identities. These properties are enough to define groups (one operation) or rings (two operations). Groups do not have to display associative and commutative properties. We can use these properties to define our systemic structure. Any system needs multiple paths to the same places or state that are equivalent. It is the transitive property that allows us to get around the system and what is outside the system is defined as intransitive due to the systems boundary. If we only have transitiveness then we have a system that can be described with mathematical category theory. Adding reflexivity we have a system wherein each element can be recognized as itself at any moment. This depends on truth as verification which will be called upon to make sure A=A at any given point in time. This makes the system definite and determinate instead of fuzzy and indeterminate. Reflexivity establishes the truth value of any given system. Following August Stern and his matrix logic we can

identify four truth values true=1, false=0, neither true nor false= -1, and both true and false = 2. These have been the truth values of Indian logic from time immemorial. Our tradition has always followed Aristotle in positing excluded middle in order to make all things definite and determinate. However, this causes logic to have fundamental problems when applied to phenomena in the world. So reflexivity is not a simple straight forward concept but has complexity of its own implicit in the statement that A=A. We must verify that A does indeed equal A. And that verification can come up with the wrong answer and it brings us face to face with the indeterminate nature of existence when we cannot decide if A=A or not. If A does not equal A then that may be because it is ambiguous in which case it is both true or false or because it is the wrong question. Perhaps A does not exist in the system any more in which case it is impossible to verify so it is neither itself nor not itself. This point of reflexivity that calls us to consider the logical possibilities can be associated with what has been called the singularity within the system that is the point of the introduction of order. It is order that makes everything what it is so it can be verified to be itself and not something else. So ordering is assumed to be the basis on which verification is carried out. Notice that the singularity is like a reflexive point within the system. This to say that order is created by the production of multiple copies of the same pattern emanating from the singularity. We can see the A=A in a different light where the "=" is seen as the singularity from which two elements of the same kind are emanating. At such a point we can verify that they are indeed two identical patterns and get answers in the range from 2 to -1. Thus it is possible to view reflexivity as the principle means of order production where a pattern is reflected in multiple directions out of the singularity were order is inserted in the dissipative system.

Symmetry [A=B, B=A] is also important. With this property balance is added to the algebraic system. Symmetry underpins both reflexivity and identity. Reflexivity knows itself as itself because symmetry of equality is posited. Identity allows duals to be distinguished and the identity point to become visible because symmetry is posited first limiting the significance of equality. Only later do inequalities arise to produce constraint based systems that break the symmetry law. We can think of reflexivity and identity as symmetry preserving properties but the difference between them is a symmetry breaking. Thus the algebraic properties posit symmetry and preserve it but find a way to differentiate reflexivity and identity which breaks a symmetry within the algebraic system. Only a system with a single element can be both reflexive and identical at the same time.

Now let us consider identity. Whether we are talking about a ring or group identity occurs when there are elements which do mirroring. Such elements produce opposites within the system that are duals across the mirroring. If these opposites are brought together they equal the mirror point. Similarly if the mirror element and any other element is combined then the other element is the result. We can see that the identity point is the point of symmetry for dualities within the system. We have already noted that the symmetry point within a system which projects duality on all the elements of the system and is locatable within the system as one of its elements is necessary and implicit within the dissipative system. This symmetry point or identity element is the center form mirroring within the system. Mirroring is necessary if any kind of intertransformability is to occur with the system. Intertransformability is the heart of all algebraic processes. Reflexivity creates discrete elements and identity allows the minimal transformations of something into the identity element via its opposite or of something into itself via the identity element. Groups will include many other kinds of transformability which allows certain elements to combine with other elements to produce still other elements. But these transformations take place in a field of duals which are organized around the symmetry element. Rings supply two operations instead of just one as in the case of groups. Of course there is no limit on the number of possible operations. Operations normally have opposites as well like +&- or *&/. A ring of four operations appears to be the lowest threshold of complete intertransformability. The mirroring around the identity elements within the system is what provides the basis of this intertransformability allowing things to turn into their opposites and back again around the centers of identity.

All dissipative systems have these properties of reflexivity and identity as their epicenters. These epicenters bring into play logic and algebra. Logic comes when we attempt to verify reflexivities and algebras come about when we intertransform elements in a field of dualities around a symmetry or identity point. What is interesting is that Godel's proof involves exactly these two elements. What he calls "arithmetic" is really the combination of logic and algebra. When you combine logic and algebra after a certain threshold of complexity you create a situation in which verification of the system itself becomes impossible. Thus no system can be proved based completely on its own axioms. In such systems there are always unprovable assertions that are undecidable. Thus we see that when we speak of the dissipative system as having two epicenters (reflexivity and identity) we are bringing into play the proof of Godel that makes such a system open and undecidable. It cannot be closed off completely by basing it on its axioms. And of

course there is a relation between undecidability and uncomputability. So such a system must have within it undecidable and uncomputable moments. It is necessary to find these by trial and error within the system. That means that the ordering of a dissipative system is never complete. It cannot be completely determined by its axioms or ordering principles but there is always a trial and error ad hoc determination of specific cases that are theoretically undecidable and there are always points within the system that are singularities which are non-computable and need to be approximated by heuristic methods. This is a fundamental limit to all our formal systems. We develop structural systems in order to explain these gaps that necessarily appear in any in any even simple combination of intertransformable elements and their associated logics. The systems itself is delimited by nontransitivity of the boundary. Within the system the elements must be transitive so that multiple pathways result in attaining the same end. Where transitivity breaks down then on has reached the boundary of the system.

We will call these three properties (reflexivity=truth), (identity=identity), and (nontransitivity=reality) the fundamental basis for modeling any dissipative system. It turns out that these properties when equated to truth, identity, and reality have an ontological significance. Truth, identity and reality are the three sub-concepts of the overarching concept of Being. Symmetry can be seen as representing the overarching concept of Being itself. Being is a single kind that covers all things, entities, objects, relationships, meanings etc. Traditionally it is dissected into three sub-concepts which give force to the overarching concept of Being. Reality is the dissonance between our concepts and our perceptions or between or recognitions and our understandings of memories. Reality is the place where our consciousness encounters the world where things are not as we would wish them to be. As we are ordering our existence reality is where our ordering encounters and perhaps conflicts with the orderings of others. Truth is the comparison of statements to states of affairs. But this comparison which allows verification of statements presupposes the appearance of language. Language is the thing that allows us to order ourselves and the world. No one has adequately explained why language exists within our consciousness and within the social lifeworld. Language is taken for granted without being questioned. We explain it by the fact that consciousness or the social lifeworld are both dissipative systems. Such systems require ordering from nowhere. Language for human beings is the way ordering from nowhere manifests to us within our ecstatic projection of the world. On the level of desiring machines this ordering from nowhere appears as semiotics (the appearance of signs). On the level of the individual this ordering from nowhere appears as

thoughts in our heads. On the level of the social this ordering from nowhere appears as language. It is necessary for ordering from nowhere to exist if we are dissipative systems at all these levels. This reinforces the point made by Heidegger that language is foreign to us and "It speaks" beneath our chatter. We assume that the two epicenters of the ellipse of consciousness are the same. We assume that we are identical to our self-talk. However reflexivity and identity are not the same. Reflexivity indicates the emergence within consciousness (individual or social) of an ordering principle from nowhere called Language. Earlier peoples like the ancient Greeks did not identify the languaging in their heads with themselves. They recognized it as an awesome foreign intrusion that they identified with their diamon (an inner voice separate from themselves). In modern times, except for a few philosophers like Heidegger, we have made the mistake of thinking that those voices are our own. We have seen reflexivity as being the same as identity making the ellipse of consciousness into a circle as Jahn and Dunne have done in The Margins of Reality where they present a quantum theory of consciousness..

Identity is something very different from reflexivity. We identify it with what is normally called the unconscious. We follow Matte Blanco in defining the unconscious as everything that is symmetrical. In this case we mean symmetrical around the identity axis of the system. We do not see what is symmetrical. Groups are entities that you can do an operation on to bring the entity back into congruence with itself so that if you only saw the entity before and after you would not know it had changed. All the symmetries within consciousness hide those symmetrical contents from us. We can only see the asymmetrical. The identity point is the axis around all the symmetries of the unconscious revolve. Thus we see the symmetry propoerty defines what is unconscious within the system. We experience this as the center of our self, the source of our "identity." Since speech or thought are asymmetries they cannot be the same as the identity of the individual. Another important point is that which Deleuze and Guattari mention which is that for some content of consciousness to be associated with the unconscious that it must be orthogonal to all other such contents. If there is any relation with something else then the contents is not related to the unconscious but to consciousness. The orthogonality of contents related to the unconscious is the test we must perform to know if we are dealing with something from the unconscious. For us to see those contents means that the symmetry of the unconscious has become broken and those unconscious contents are what is revealed by the asymmetry. If the symmetry had not been broken we would never have seen them as we cannot see anything from the unconscious that is held in the embrace of symmetry. Desiring machines that

make up the individual are all orthogonal as nodes of the autopoietic system. Orthogonality ensures non-interference between the operation of the nodes of the autopoietic system. These nodes array themselves around the axis of symmetry and interact to produce the workings of the autopoietic machine. Each part is separate and distinct with its own unique action as an ordering principle and acts together with the other ordering principles to produce the autopoietic system out of itself.

What is interesting is that the asymmetries and actions of the autopoietic system are arrayed around the identity point of that system. These arrays of nodes, asymmetries, actions, and groups form patterns at different thresholds of complexity. These thresholds of complexity include the dissipative, autopoietic and reflexive levels of special systems. Notice that at all three levels identity, truth and reality play an important part. However the different levels have different emphasis on these three constituents. For instance at the dissipative level identity is de-emphasized and truth and reality are emphasized. At the autopoietic level identity of self with self and the boundary in reality are emphasized. At the reflexive level reflexivity and identity are emphasized. Thus at each level is a pair of these concepts that receive the most attention and one concept plays a lesser role. For the reflexive system the boundary is not very important. For the autopoietic system reflexivity is de-emphasized. For the dissipative system it is the identity element that is de-emphasized.

Of course at the real and complex levels both the associative and commutative properties still hold as well as these core properties that define the ellipse of the dissipative system. Then at the level of the quaternion autopoietic system the commutative property falls out. At the level of the octave social system the associative property falls out. In both cases a property failing introduces asymmetries into the system. When we move up to higher levels that we might imagine, but do not actually exist mathematically, we do not even have transitiveness so there are no algebras at all beyond the octave. Without transitiveness there is no system and reflexivity and identity alone are not enough without a field of transitive elements across which they operate.

The question that is hardly ever asked is why do we want intertransformability in the first place. This is the way we project a continuous world within which we can get our bearings and within which we can transform other things at will. Continuity and the intertransormability that uses it is a basic component of our will to power.

General systems theory such as the one developed by George Klir seeks to recognize systems as objects. The object is looked at as a source of attributes that are quantified by attaching variables to phenomena. Some of these variables are designated as backgrounds and others are foreground measurable properties. Thus the source system become a data image. Then we look at the question of how to simulate that data we are observing and we begin to define generative systems. Such generative systems will execute algorithms to produce the correct data streams to emulate the system. Once we have achieved fidelity at generating the right data streams we assume that we have an accurate simulation of the system producing the same patterns as it would produce. This fidelity is achieved by increasing meta-levels of structure and modeling. Structure refers to the production of patterns and modeling refers to temporal changes in patterning. If we assume that any given variable can be ordered at any level in the lattice of methodological distinctions (no order, partial order, partial order with distance, linear order without distance, or fully ordered) then general systems theory should be able to simulate any system at any level of ordering. This simulation assumes that the system is computable. If the system is not computable then such a simulation will abstract from and approximate the object system. This is the general systems theory which based on this generic simulation structure can calculate all possible systems architectures. We can start from any given system and attempt to work out its generic systems architecture or we can start from a specific system architecture and look for actual systems that embody it. Thus general systems theory gives us a basic mechanism for recognizing order producing systems and for simulating them at any level of possible order from no order to fully ordered. Such systems do not make any assumptions how many ordering principles are at work in the object system. The object system once demarcated is modeled regardless how many different ordering principles are at work. But not making any assumptions really amounts to assuming that the object system has a single ordering principle. Since the whole point of structural and modeling meta-levels is to approximate the ordering principle of a system and then generate that behavior like the behavior of that ordering principle what general systems theory really does is focus on objects with a single ordering principle. It projects that single ordering principle if it does not exist. It is important to realize that this view of systems as objects is a reduction of what a system really is. A system is a gestalt not an object. This is to say that a system is a showing and hiding pattern that appears to us within our perception. Some times there are hidden aspects of systems that we need to project cognitively in order to explain everything that we see and to distinguish the things that are really there from the artifacts of our perception. Structural models assume that

objects or forms are made up of primitives that have structural relations to each other. These contents are manipulated by structural rules to produce simulations of the forms we see. These structural rules are contained in the structures and models of general systems theory. Structural systems operate in time unlike formal models. Structural models do not prove anything but only explain. So structural models are significantly weaker than formal models but have aspects dealing with discontinuities and time that formal models cannot approximate. We can think of structural models as formal models dealing with the content of forms instead of the forms themselves. Structural models are really meta-formal models of content. In such models it is important to have intertransformability between forms. In fact positing the field of content and then showing the transformations that take us across the discontinuities between forms is exactly what intertransformability accomplishes. Intertransformability allows us to bridge the gap from one form to another. We can see it this way. Numbers are created according to the formal system of algebra. But specific sequences of numbers are created by a structural system operating on that formal system to give specific sequence of numbers over time. Thorough the generation of the sequences of numbers in variables we are simulating the system or we could just be observing these sequences of numbers in the source system. Either way we are bounded by the form of numbers to producing numbers in a certain way that form streams through variables that in a simulation create illusory continuities that emulate the action of the system itself seen from a quantitative point of view.

So intertransformability is our means of simulating systems from a quantitative viewpoint. This of course is a reduction of all the variety that occurs in the real system to just a series of numbers. But once we have decided to make this reduction then we can be sure that we will only have numbers and that numbers when manipulated will only yield other numbers within our simulation or observations. In fact physics and mathematics both find that numbers that are intertransformable have an amazing ability to simulate the external world accurately in many of its fundamental aspects. Our advanced structural science is a proof of this. So intertransformability serves us well as it gives us a closed system of quantity within which any number can become any other number by the appropriate transformations and in this way we simulate or measure the quantitative aspects of our world sometimes to a high degree of accuracy.

But what about quality? Should we not have an intertransformable system of quality to match that of quantity? Why do we neglect quality when we over

emphasize quantity? This is a cultural bias. There is however no reason not to have intertransformable systems of quality which are equally as complex and accurate as the systems we have for quantity. In fact there is a direct relation between systems of quantity and systems of quality. Systems of quantity demark the elements of a system and their movements in spacetime. Systems of quality summarize the states of these elements or groups of them and their state changes over time. The quantitatively defined system has a certain number of elements and the system is defined by the relations between these elements. Each element has measurable attributes that can be seen as a source system in Klir's terminology. There are N^2 relations between the elements of a system or A^2 relations between all the attributes of these elements. We can portray these relations with a Lano N^2 chart. On the other hand there are 2^N different overlappings between elements in a system or 2^A different overlappings between attributes. One can use a Venn diagram to view these different overlappings. Notice that Venn diagrams are also used to portray logical situations. So Venn diagrams are related to the reflexive property of systems and Lano charts are related to the identity property of systems. One displays overlappings of entities or attributes while the other displays the relations between entities or attributes within a system.

One of the major questions I have had and have attempted to research over the years is the relation between quality and quantity. Recently I realized that the difference between them are implied in this difference between 2^N and N^2. Qualities are merely the overlappings of things within a system. It is quantity that defines and delimits the things and shows how they interact in a non-overlapping mode. However, if we ask what quality is then we discover that the number of qualities a system can have is the number of overlappings of its things or the attributes of those things. The overlappings are what separate the things from the whole of the system of which they are a part. Thus by definition all the qualities a system can take on are merely the number of possible overlappings between the things and attributes of a system. We can generate a picture of the qualities of a system by creating 2^N fuzzy combinations of entities or 2^A fuzzy overlappings of attributes. Such a system is perfectly intertransformable if we model it on the I Ching of the Chinese. In such a system each qualitative state has N or A lines that are either whole or broken signifying Yang and Yin. Yang and Yin are generic opposites. In considering the system one needs to identify a series of fundamental opposites that are permutated to arrive at a combination of opposites that describe a particular system state. Once this production of permutating opposites is identified then changes from one state to another is made by changing these broken or solid

lines by known rules. The I Ching is a ring of 64 states. Any state in the ring can be transformed into another state in the ring through a single transformation involving one of the other 64 states. Since the I Ching is thought to be the oldest book in the world this model for states has been around and used for a long period of time. Converting a system into all its possible states is no more difficult than producing numbers from observation. However there is quite a bit more art to identifying system states and showing how transformations from state to state are occurring. But this answers the question of how an intertransformable system can be produced for qualities and how many qualities are there for any given system.

 The next question is what is the relation between quality and quantity. Since these are fundamental categories appearing in Aristotle and Kant's tables we can assume that they are some of the most basic ideas that exist. Yet it is hard to decide whether something should be looked at quantitatively or qualitatively. Here we borrow from Baudrillard the concept of using the Mobius strip to define the relation between two concepts one wishes to distinguish. Locally Quality and Quantity appear different like the mobius strip that locally as two sides and two edges. But globally quality and quantity are the Same just as globally the mobius strip has one side and one edge from the global perspective. Thus everything that can be seen quantitatively can be viewed also qualitatively and taking a global perspective there is no difference between these two. Thus we can say that locally quality is like the wine in the glass and quantity is like the glass that holds the wine. But globally there is no difference between the wine and the glass. This comes to the for if we go back to the I Ching. When considered as a ring we see that between every two hexagrams there is a third transforming hexagram. This transforming hexagram can be seen as the wine acting as glass to the two other hexagrams that are the endpoints in the transformation process that are glasses acting as wine. Note that we could be talking about any number N or A and that the number N=6 is only used here as an example. Each level of qualitative intertransformability is independent and can be used as a heuristic for looking at a system. Thus if a system has N elements or A attributes then any number up to N or A can be used to create permutatable opposites that create a field of all possible qualities for the given system.

 Now once we have understood the relation of quality to quantity in terms of the mobius strip it is possible to return to our hierarchy of specialized systems and general systems theory. General systems theory deals with gestalts which appear in perception or cognition or both (or which are recognized or remembered). Within these gestalts we recognize or perceive entities and their attributes. We can produce

an intertransformable field of quality or a separate field of quantity in order to explore and simulate these systems. Whether we view them qualitatively or quantitatively is left to us. But which ever one we chose we are going to have a problem with respect to the other. If we measure everything then its qualitative aspect will become problematic and undecidable. If we look at qualitative states then the quantitative aspects will become problematic. There is a wicked trade-off between these two in most cases. Since our culture is oriented toward quantity this wicked trade-off occurs in most cases on the side of quality. The best procedure would be to attempt to observe both and then one can see more of the phenomena. However, like the indeterminateness of the light slit experiment so too these two ways of looking at the world are probably incommensurate. It is really a repetition at a higher level of the particle and wave undecidability. The overlappings are like waves and sees the system as a big interference pattern. The quantitative way sees relationships between entities that are like particles. So if we apply the dictum that the Copenhagen position is untrue and there is no cutoff between macro and micro then we will see that Quantum Mechanics applies to the macro-world as well as the micro and the indeterminateness between quality and quantity is an extension of the wave/particle duality. We call the actual phenomena that is being observed a wavicle (lave) or eventity. Everything in existence is undecided between whether it is an expression of quality or quantity. It resolves to one or the other when measured. But this is only to say we decided to look at it in terms of quality or quantity. Thus the observer become intertwined with the system under observation.

What is said here about quality and quantity is similar for other fundamental distinctions we make within the world. All of them have this mobius strip local/ global difference which makes it impossible to discreetly cut up existence one way. Instead there are multiple interfering ways of cutting up existence. Different people will see different systems gestalts of the same object. They will identify the entities within that system differently and will single out different attributes to observe. Even if they could agree upon what to observe they would interpret the results differently. This is part of the variety production of the human being and as science has shown it is very difficult to get confirming evidence for ones interpretation of phenomena. However, science exists because it is sometimes possible by round about means. Baudrillard shows how the same undecidability applies to other distinctions such as concrete/abstract, social/technical and use/exchange value. We could add to this list an indeterminate number of other undecidable distinctions.

So general systems theory and even the whole of science suffers from this basic

problem of undecidability between quality and quantity and other fundamental distinctions. Our cultural bias is to consider quantity and forget quality taking this obsession to unfortunate extremes. Other societies have other biases. For instance the Chinese took the view of the world as qualities to an extreme in the other direction. We would prefer to use both of these ways of looking at the world together and learn to live with and recognize the undecidability that they entail rather than ignoring it until we reap all the negative consequences of over emphasis of one or the other approach to things.

  Now we have posited that any system may be viewed as a gestalt either qualitatively or quantitatively. Now let us consider the special systems that we have introduced above. What we notice about the dissipative system is that it is a mobius strip itself of flowing energy. When we approach it both qualitatively and quantitatively we get a different view. We know that our fundamental distinctions we are making are also like a mobius strip. Therefore the thing we are looking at (the dissipative system) and our apparatus for looking at it form an autopoietic system. Suddenly we can see that there is a congruence between our undecidability and this special kind of system in the world. This makes us suspect anthropomorphism is at work. However it also explains the closure of our system of thought and how it functions in a paradigm only seeing what it expects. Because our way of looking at the world has a special relation to the this kind of system in the world we would expect to see dissipative systems everywhere and for those systems to pop out at us. In fact order generating systems form very good gestalts for us as human beings, better gestalts that passively ordered images. But here is another consequence. We tend to see things as order producing principles. This is why we see systems in the first place. In fact we consider all systems to have their own internal order producing principle until proven otherwise. So we tend to see things as dissipative systems until we prove they are not dissipative. Once we recognize them as dissipative then they can easily be considered qualitatively or quantitatively and we know that globally these two seeming opposites are really the same thing. That is why the object system remains identical to the source system in Klir's terms. All the concrete details that Klir is ignoring because he does not have a system of qualitative intertransformability are assumed to be the same with what is measured. Many times this is a false assumption and there are artifacts produced that cause false measurement due to ignoring the qualitative aspect of eventities.

  Now we have gone into detail showing how the complex numbers have a relation to the dissipative system so that it lies at a specific quantitative threshold of

complexity. We can go on to speak of how the dissipative system also has a qualitative aspect based on how many entities or attributes we identify in that dissipative system. The system can be seen as an interference pattern of waves instead of a set of discrete entities with mutual relationships. In the interference pattern each possible overlapping of entities or attributes is a ground state of that dissipative system. Since the system may have many entities we can choose any heuristic up to the number of entities to look at the system. So we could decide that there are two fundamental distinctions and generate a heuristic with four states through which we understand the qualities of the system. Each distinction we make has a built in undecidability globally and is only decidable locally in the act of observation.

So when we talk about the dissipative system and its energy expenditure which allows it to generate order internally and to disorder the environment then we can see this system as a large interference pattern with multiple groundstates. In fact what is being ordered when such a system produces order. It is the states of the system that are being ordered. Notice the cellular automata example. Here are the discrete cells that are quantitative defined but each of these has a state perhaps shown by a color. It it the colors that are determined by the operation of the field of automata. In this case the relation between quality and quantity is clear and well preserved in the form of the cellular automata. It is the color qualities that stand for system states that are ordered by the rules. This brings us to realize that within the dissipative system quality and quantity have a special relation. They are balanced and the order from nowhere orders quality. That ordering of quality moves thorough the system as it dissipates like waves on the sea until it interacts with the environment were it crashes like waves on the shore disordering the qualitative states of the environment. This action produces the quantitative determination of the dissipative system as a single thing. When we see global patterns like a boundary or patterns within the system these may be illusory since the automata field is just computing the states of each node's neighbors. So the juxtaposition of qualitative and quantitative views can be producing illusions of wholeness or interaction that do not in fact exist. However, in the dissipative system quality and quantity are juxtaposed in close proximity to each other so it lends itself to a balanced quality/quantity treatment by the observer. As observers we entrain with dissipative systems forming autopoietic systems easily. Dissipative systems offer infinite variety of stimulation for us to project patterns on. Those patterns can be easily seen as either qualitative or quantitative.

The ultimate expression of this qualitative aspect of the dissipative system is the mandelbrot set or the Julia sets of which it is composed. Here we have infinite differentiation into fractal patterning. Here we see the qualitative aspect of the dissipative system in all its glory. Each quality is expressed as a color to us so we recognize the pattern visually but each difference is really a line of flight toward infinity that has been categorized by color coding. But we see amazingly complex patterns here at levels of magnification that go beyond quarks if they were physical magnifications. This qualitative field of tendencies or propensities is numerically calculated but if all we had were numbers we would have a much more difficult time discerning patterns. Each point in the field is independent and is calculated by iterative multiplication. In the case of Julia sets a small complex twist is given to the numbers when they are calculated to produce different patterns.   In this production of the fractal patterning of the complex number fields inherent tendencies we are combining complex and quantitative views very closely in order to visualize the inherent pattern. But because we use this technique of combining them does not mean that they fuse. Quantity and quality remain separate here. But by employing them together we get a better view of the intricacies of the complex numbers and their algebras which lies at the same level of complexity as the dissipative system. Infinite propensities forming complex patterns to any level of magnification is about as complex as you can get. Thus our word "complex" for referring to the number system and to things that are very complicated becomes undecidable or allusive in the end. Complex numbers are the very epitome of complexity and complicatedness when we focus in on the level of propensities of each number in the field to go toward infinity at a certain velocity that can be coded by colors.

The mandelbrot set operates at the level of the complex/dissipative systems. Similar patterns of more complex propensities operate at the higher levels of the quaternions and octaves. At those higher levels quality and quantity views can be closely juxtaposed. We get our best view of these systems when we balance quality views against quantity views. Each of these higher order system can be seen as interfering waves instead of sets of entities and we can produce sets of states using heuristics that give intertransformability of quality as well as quantity. However we should not that as we lose the commutative property and the associative property these qualitative descriptions become more powerful than the quantitative representations of these systems.   Thus we are moving in to realms where quantitative simulation is more useful and quantitative representations are less useful. This is why Western science is balking at entering these realms. We are just

starting to develop means of qualitative measurement to compete with the traditional qualitative measurement methods. When we consider that such systems can also be less than fully ordered we see that the development of qualitative measures is all the more important for understanding these kinds of specialized systems that have at their root infinite variation in the patterning of the field of propensities.

Now let us consider again how this qualitative patterning appears at each level. At the dissipative level it is the qualitative aspect of the field that is modified and which makes the dissipative structures appear as illusions. In this dissipative system we have logic and algebra combined at the right level of complexity to make the system itself ungroundable in its own axioms. So the infinite pattern of propensities appears within the field of undecidability of the system as a whole. It is from the breaks in this field of undecidability that the oracular order from no where comes into being which patterns the state of the automata. Each point in this field has its own propensity that adds to or subtracts from what ordering comes from on high. This interaction between patterning principle and its embodiment is what gives the concrete dissipative system its quality. The system itself is measured in terms of the number of nodes it encompasses and by its delineating boundary. Energy flows and other measures are also possible.

When we move to the autopoietic level a much more complex situation holds. At this level asymmetries and actions, nodes and hyper-cycles arise between the two balanced dissipative systems that produce autopoiesis. The nodes may be considered as entities to see overlapping as well as the actions. Asymmetries and hyper-cycle changes cause discontinuities within the autopoietic system that lend themselves to qualitative descriptions rather than quantitative description. So we might say that a qualitative field has opened up from within the autopoietic system separate from the fields of the conjoined dissipative systems. Between this central field and the fields of the dissipative systems there is an interaction which causes the fields of the dissipative systems to differentiate from each other. This is why we can tell the perceptual-cognitive loop from the recognition-memory loop. They form a reciprocal symbiotic relation that creates qualitative differentiation. That differentiation revolves around the qualitative differentiation of the central field. Notice that the central field has upper and lower levels of logical typing associated with it. Above are the hyper-cycles giving controlling instructions. Below are the actions that fall out of the control loop that includes hyper-cycle commands and social interactions which together determine resultant actions. In the center

between these two levels are the asymmetries that allow perception or recognition to occur and the nodes that appear within the field of asymmetries that are orthogonally emergent from the unconscious. These are the nodes of the autopoietic network that work together under the auspices of the hyper-cycles to produce the system itself by maintaining its structure homeostatically through sets of actions that cause it to revolve around its ideal structural position.

Now when we go up to the level of the octave we encounter the hypercylces as protocols by which different autopoietic systems carry on semiotic, symbolic, or metaphoric exchange. The asymmetries become shared social perceptions and the actions become shared social actions. The nodes are the quaternion/autopoietic systems within the social field. Since the inside and outside of the autopoietic system are socially mirrored we could be talking here about the relation between desiring machines within the autopoietic system.

8. Out of Control

Recently Kevin Kelly has written a book called <u>Out Of Control</u> where he suggests nine rules by which God produces something out of nothing. We will consider these rules as they apply to the series of special systems: dissipative, autopoietic, and reflexive.

- o distribute being
- o control from the bottom up
- o cultivate increasing returns
- o grow by chunking
- o maximize fringes
- o honor your errors
- o pursue no optima; have multiple goals
- o seek persistent disequilibria
- o change changes itself

These principles are culled from many sources and define an emerging paradigm of complexity theory which includes chaos and fractals and other new scientific ideas that are revolutionizing the way we look at the world.

o distribute being

Kelly says that every thing in a system creates being and they need to share and

distribute that being. This relates to the fact that each node in an autopoietic system is a point of presence creating manifestation of internal and external reality for that living system. The whole is created by the independent and concerted efforts of the parts in their neighborhood and the whole gets its being bottom up from the nodes and not vice versa. We can call this the constructivist premise that we must build things and test them rather than make grand theories in order to find out what works. Or as Deleuze and Guattari say what works is a much more important question than what does it mean. All these special systems get their reality from local and neighborhood interactions that have global effects and it is through the distribution of presencing between the element of the system that the whole system has its being.

o control from the bottom up

This is the principle that caught my eye when I perused this book. It reminded me of the concept of Ashby's law articulated so well by Stanford Beer in the <u>Heart Of Enterprise</u>. This law is that if you want to control anything your control channel must be as wide as the thing you are controlling is complex. If you do not have such a channel then you are not in control. This in effect means that all control from above is an illusion anyway. There is only control from the bottom up so you might as well act that way rather than trying to pretend that you can control everything top down as most organizations now pretend.

This makes the social dimension important. Where is the control deficiency made up? It is made up by social control at the lowest level which makes people want to conform in order to be accepted. Social (heterarchical) control plus hierarchical control is the way systems maintain themselves. So control from the bottom up emphasizes social control over organizational control.

o cultivate increasing returns

Increasing returns are the opposite of a dissipative system. In such a system orders pour in. In other words instead of things flowing out to disorder the environment there is a flow of energy inward that if managed can be used to attract more energy from the environment. All the dissipative systems we have been discussing can be seen as a vortex of increasing returns instead. Thus we can create a typology:

[dissipative system -- vortex of increasing returns]
Autopoietic systems may be composed of:

* Two dissipative systems.

The normal case discussed in this paper.
* One dissipative system and one vortex of increasing returns.
Here the dissipative system forms a physical Escher waterfall.
* Two vortexes of increasing returns.
Mutually reinforcing increasing returns.

o grow by chunking

Here we see another principle embodied by our hierarchy. We add dissipative systems to get autopoietic systems and we add autopoietic systems to get social systems. The chunks fit right together additively but give emergent properties of the higher levels that fall out of the taking away of algebraic properties.

o maximize fringes

In these systems the fringes are maximized as they all have borders that are important and which are fractally defined. However fringes also means cultivating propensities which is also possible due to the field of mandelbrot and hyper mandelbrot lines of flight which form the very substance of the illusory continuity of spacetime in these systems.

o honor your errors

Errors may be creative moments not yet noticed. But this connects with what we have been saying about singularities as sources of order from nowhere. You never know what singularity will open up an ordering principle that will start either a dissipative system or an vortex of increasing returns.

o pursue no optima; have multiple goals

Because of the underlying chaotic nature of these systems they have no optima. Therefore trying to reach optima is a waste of time. Instead one should recognize that reality is multi-faceted and that one must optimize between multiple conflicting goals all the time. But even the distinctions by which we define goals are mobius strips with local/global paradoxicality so we cannot define goals ideally but must construct teleonomic responses for groups of autopoietic systems that are socially embedded. In other words we must allow the group of autopoietic systems to

evolve using genetic algorithms rather than imposing ideal unobtainable goals from the top down. This is similar to no control from above. Here instead it is no overarching vision from above.

o seek persistent disequilibria

These systems are all about making disequilibria persistent. Dissipative systems are by definition disequilibria. Autopoietic systems balance these to gain structural equilibria by riding two disequilibria at the same time. Social systems are again heterodynamic projecting a world and emergent patterns within that world. Each stage establishes meta-disequilibria of different sorts.

o change changes itself

This principle relates to the fact that these systems are ways of riding the wave of change and applying change to itself to obtain hyper-balances that would appear impossible otherwise. It is not just that we do not step into the same river twice but the very medium of the water itself is inherently unstable with its own infinite pattern of propensities that offer myriad lines of flight at different accelerations.

Thus Kevin Kelly's nine principles relate well to the special systems we have been studying. Complexity theory deals with very complex systems. But here we are dealing with certain thresholds of complexity that are mathematically defined but that express them selves as special kinds of systems that unfold from general systems theory. Together these systems define a new paradigm similar to that which Kelly tries to axiomize.

9. Kinds of Being

We have defined three types of special systems that emanate from our rethinking of general systems theory in terms of ordering. In these special systems ordering become dynamic. In the dissipative system one order is supplanting another order dynamically. In the autopoietic system there is a dynamical balancing of at least two orderings. In the social system there is a reflexivity of orderings in infinite self-reflection within and without the autopoietic system in which ordering mirrors itself. This reflexive mirroring of orderings is the primary means of projecting the world by the social group. The group can change the ordering to new and emergent orderings and the social group can remain stable because at the highest level the meta-ordering is more important that the ordering. Meta-ordering is the

heterodynamic ecstatic projection of the world as the realm in which all orderings occur. The meta-ordering establishes the possibility of ordering within which all orderings can occur. Meta-ordering is logically prior to all orderings that can be projected or seen within the world. We call this meta-ordering "worlding". In another paper <u>On The Social Construction Of Reality: Part One</u> we constructed an emergent ontological hierarchy with the following levels:

Structure
Form
System
Meta-system
Domain
World
Universe
Pluriverse

These are the dual of the phenomenal emergent levels:

quark
particle
atom
molecule
cell
organism
society
gaia (ecosystem).

The phenomenal emergent levels can be defined many ways but they generally demark the basic phenomenal levels isolated by science. We can look at any of these levels through the lenses of the ontological emergent levels. The point of the ontological emergent levels is that we can isolate forms at any level of existence and then produce structural explanations for them. This is how the particle and quark levels were discovered by physics. But looking at things in terms of systems and meta-systems is the opposite of structuralizing them. Systems are gestalts and meta-systems are systems of gestalts that operate together to create higher level showing and hiding relations. For instance a software program may be considered a

system but the operating system is the meta-system. A domain looks at many different systems of similar type and attempts to see trends in such domains. Domains have different ordering principles. Meta-systems express these ordering principles by organizing showing and hiding relations of different kinds together. Thus the domain expresses the ordering while the system expresses the showing and hiding of a gestalt that expresses that order. The meta-system allows different showing and hiding relations and different ordering domains to function together without interfering. A world is the organization of all the different ordering principles and all the possible showing and hiding relations. A meta-system will just combine a few ordering principles with a few showing and hiding relations but a world is the panoply of all possible ordering principles and showing and hiding relations. The universe is an abstraction which unites all possible worldviews usually with the aim of reducing them all to some lowest common denominator such as physical phenomena. The pluriverse is the connection of all possible worldviews without such a reduction.

 With any showing and hiding relation there is the thing shown which assumes a shape or form. Structuralism reduces this form to contents and formalizes the contents to explain transformations across discontinuities from form to form. Modern science is very good at applying structuralism to forms to get forms at lower emergent phenomenal levels and then does the same thing to those till it reaches phenomena such as quarks that are inseparable. When structuralists look at the world they see projected structural distinctions out of which forms are produced. The same structural distinction will create dualities in different forms. For instance in America there is a structural distinction between black and white on the socioeconomic level but that over-determines many forms that are constructed socially within our society so that even things like the fact that salt and pepper is found on our tables as the most probable condiments are a mirroring of that fundamental structural distinction. Structuralists look for the fundamental structural distinctions of content that forms are constructed from. These distinctions whether physical or social or whatever are the fundamental matter out of which all forms are constructed. These forms then appear in showing and hiding relations and appear as gestalts which we call systems. Different systems may operate in the same arena where certain rules control their interaction and these are called meta-systems. Meta-systems combine different ordering principles and different showing and hiding relations into a single arena. Domains identify the scope of a specific ordering principle. Structural distinctions are manipulated different ways by different ordering principles. The world includes all possible

structural distinctions, all possible forms, all possible systems, all possible meta-systemic arenas, and all possible domains. The world is the ecstatic projection of the heterodynamic system. All worlds together is the pluriverse and the reduction of different worlds to some lowest common denominator is called the universe.

Dissipative autopoietic social systems 'world' the world as a projection of reflexive ordering within the double mirror inside and outside the autopoietic system which balances dissipative orderings. This worlding of the world is equivalent to the projection of Being as differentiated instead of undifferentiated. We have already seen that at the quaternion/autopoietic level undifferentiated Being arises between the two dissipative systems. At the octave/reflexive level this undifferentiated Being becomes differentiated. We noticed that kinds arose at the autopoietic level and that the marriage of kinds of a kind occurred at the octave level. Here we see that Being becomes differentiated by being articulated into kinds of Being. The realm of asymmetries that opens out of the autopoietic system becomes the theater of presencing and manifestation at the social level where discrete beings or entities appear to the socius. The socius is the constellation of socially connected autopoietic systems or the primitive group. Sartre calls it the fused group. Cannetti calls it the pack. It is the primal emergent social grouping from which all other social organizations spawn as various reifications. Sartre catalogs these in Critique Of Dialectical Reason [Volumes I & Ii]. When Being becomes differentiated then a spectacle appears within the world. This spectacle is composed of many different kinds of beings. There is a difference between the entities that appear within the spectacle and the spectacle itself. This difference is called Ontological Difference by Heidegger. It is the difference between beings and their Presence or Manifestation in Being. Being is the "substance" that allows the World to be projected. It is the embodiment of the projection itself as an act of transcendence by the social group acting together in the social construction of reality. Until recently the "substance" of Being was considered the highest concept and to be unified following the lead of Aristotle. In recent philosophy the unity of this overarching concept has broken down. It has recently been realized that there are several different kinds of Being. This articulation of the most general Kind "Being" of which all entities are instances into different sub-kinds is referred to as the Fragmentation of Being. The history of this phenomena has been treated in the authors work The Fragmentation Of Being And The Path Beyond The Void.

The ontological theory presented here to attempt to understand the differentiation of Being is that the fragmentation of Being has a certain specific form of

differentiation into meta-levels of Being. Each kind of Being is a meta-level over the last level of Being. There can be exactly four different kinds of Being because these meta-levels do not go off to infinite meta-levels but hit a barrier of unthinkablity after level four. The meta-levels of Being are as follows:

```
being
------------------------- ---> ontological difference
Pure Presence (Being^1)
Process Being (Being^2)
Hyper Being   (Being^3)
Wild Being    (Being^4)
------------------------- ---> emptiness
ABYSS infinite illusion
```

o **Pure Presence** is the projection of the spectacle of socially constructed beings embedded in illusory continuity. Pure Presence is the static NOW point of what the transcendental infinitesimal moment. Pure Presence is associated with Calculus Mathematics which determine transcendental limits as ideal points.

o **Process Being** is the mixture of Time with Pure Presence to produce the temporal gestalt within the specious present. The specious present has duration and within that duration a whole form moves from epiphany to its vanishing point differentiating and evolving. The temporal gestalt is the complete whole that includes the temporal unfolding of the form instead of just the momentary snapshot of Pure Presence. Process Being is associated with Statistical Mathematics which approximates probabilities as stochastic constellations of actual points.

o **Hyper Being** is the mixture of the manifest with the unmanifest. At the level of Hyper Being the unconscious appears as an absence which orders things. Hyper Being is described by Derrida as DifferAnce (differing and deferring) and by Heidegger as Being crossed out. It is the cancellation of Sartre's Nothingness with Process Being. In that cancellation the unmanifest manifests by its action on the manifest usually seen in displacements and warpages of the continuum of Pure Presence or breaks within the unfolding of processes within Process Being. Hyper Being is associated with Fuzzy Mathematics which hedges possibilities as potential clouds of possible points.

o **Wild Being** is what remains after the cancellation of Process Being with Nothingness its antinomic opposite. Wild Being was defined first by Merleau-Ponty in <u>The Visible And The Invisible</u>. Wild Being exists as the threshold of thriving or the edge of chaos where the manifest and unmanifest intersect. Wild Being is associated with Chaotic Mathematics which embodies propensities as tendencies of immanent points.

Beyond the meta-level of Wild Being one hits the unthinkable which can be interpreted as equivalent to the Buddhist concept of Emptiness that is empty itself. Emptiness is a non-experience and non-concept which can only be indicated from Being with all its kinds as its dual. The Buddhists take this improbable position as their basis for approaching existence instead of Being. Emptiness was realized by the Buddha to be the absolute middle of the myriad nihilistic opposites generated by the Hindu and thus Western tradition. Buddhism takes as its way the middle between all the possible nihilistic opposites. In doing so it negates Being in all its forms and at each of its meta-levels.

What exists beyond emptiness, the unthinkable limit, is illusion. There is the abyss of infinite illusion. This is what is ultimately projected on the screen of shared asymmetries by the group of autopoietic system. The dual mirroring produces an illusion just like when two mirrors are stood opposite each other. The dual mirroring goes off into the distance reproducing the patterns in the other mirror seemingly infinitely. Here the two mirrors are the social character within the autopoietic system and the social character outside the autopoietic system. This dual mirroring which Baudrillard calls the mirror of production and Lacan calls the mirror stage of the self is the ultimate projection of the social autopoietic system on the screen of emptiness. The four sub-kinds of Being are the mechanism for making this projection. The entities within the world appear within the web of this illusion.   We isolate those entities first as noematic nuclei within our overdetermined glossings, then we see their kinds with eidetic intuition. The world is a projection of the dissipative autopoietic reflexive system. It is a projection on emptiness thorough the different kinds of Being that allow each entity to be isolated out of the complete projection. Entities are not separate units with being in isolation from the worlding of the world. Instead entities appear within the dynamic gestalt of the worlding of the world and then are isolated and reified turned into objects.

Emergent entities must pass thorough all these meta-levels of Being in the process

of manifesting as new things. As such they rearrange the temporal gestalts that appear within the projection of the world. Emergent entities repattern or projection changing interpretations of Being, epistemes, paradigms, theories or facts. All genuine emergences pass through all these levels. This is because the social must project the whole of the world and that whole projection occurs on the basis of the four different kinds of Being. If an new thing does not effect all the different levels of Being then it is not a genuine emergence. Genuine emergences are equal to the whole world because they can change the ordering of that whole world. Autopoietic systems have the structure of emergent entities. This is to say Autopoietic systems are themselves equal to the whole world. Each autopoietic system within a social group projecting a world is equivalent to the whole world. Autopoietic systems are structured in such a way that they embody within them all the different levels of Being at one time. All these levels are rolled up within them so that the mechanism for producing the world is not just something that appears outside the autopoietic system but within its deep structure as well. Each autopoietic system is continually emerging and that is how emergence can be introduced within the world and that world can be completely repatterned. The autopoietic system embedded in the social meta-system always is emerging as a heterodynamic source for the projection of the world.

We posit that the undifferentiated being produced by autopoietic systems becomes differentiated within the social realm and that it is differentiated by the unfolding of meta-levels of Being. This ontology is empirical and scientific because it calls for the effort to think the fifth meta-level of Being as thinkable rather than unthinkable. Each higher meta-level of Being we can think will expand the possibilities within our worldview giving a new dimension to the clearing-in-Being. The clearing-in-Being is the realm where all the asymmetries of all the independent autopoietic systems overlap. The clearing in Being is marked by the appearance of the Positive and Negative Fourfolds. The positive Fourfold was articulated first by Socrates as HEAVEN, EARTH, MORTALS, and IMMORTALS. Its dual is the Negative Fourfold articulated by Aristophanes in the play <u>The Birds</u> which is NIGHT, COVERING, CHAOS and ABYSS. These two archetypal ontological formations underlie the way our worldview sees everything. These dual Fourfold formations appear as the basis of all our ontologies within this worldview. The articulation of the clearing-in-Being as the place within which transcendence is projected and immanence is realized is the heart of the social. It is the emergent aspect that unfolds at the level of the octave/reflexive. The different kinds of Being are the differentiation of Transcendence into meta-levels. This operation of transcendence

allows us to distinguish between heaven and earth and between mortals and immortals (and similarly between animal and human). But what is normally forgotten is the differentiation of immanence within the clearing-in-Being into the negative fourfold, i.e. all that is obscure, indistinguishable and hidden. In our culture the Positive Fourfold is related traditionally to Maleness and the Negative Fourfold is related to Femaleness. Thus the differentiation of kinds of a kind that are united in marriage at the reflexive level has a basic ontological signification that uses the visible markers of male and female to encode ontological meanings.

Between these two Fourfolds is a basic differentiation which is invisible from the point of view of either. We call this basic differentiation the unwarped viewpoint. We relate it to the viewpoint of traditional Chinese Science. From that viewpoint there is no split between Logos and Physus that occurs in the Western worldview. That split gives rise to the duals Physus in Logos (language as independent from us the speakers seen for instance in puns) and Logos in Physus (the ordering power of mathematics beyond physical phenomena). In Chinese Science there is a different picture. There is the Yang of unseen causation that strikes the Yin of created things. In this interaction Chi (growth energy) and Li (patterning) are produced. We understand creation through the Chinese Scientific worldview through the interaction between various Chi (energies unfolding in creation) and Li (ethereal ordering principles). From this viewpoint it is the interaction of Logos and Physus with their different energies and ordering principles that cause the illusion of the Positive and Negative Fourfolds to appear. If we do not split Logos from Physus but see a single energy and single ordering principle that arise out of the interaction of unseen causes and seen things then what arises is an unwarped picture of the Clearing-in-Being. In the unwarped picture dominating transcendence disappears and thus immanence is not generated as its opposite. It becomes merely a Clearing and both Being and Non-Being vanish. In that clearing we can see a series of heuristics that come from the permutation of Yin and Yang. At the first level there is the unseen cause striking the seen things which produces unfolding growth energy and an ordering principle. There is only one ordering principle for each thing and thus no competition between ordering principles. At the next level of heuristic there is four permutations of yin and yang giving: Major and Minor Yin and Yang. These were related to the celestial lights by the Chinese:

```
Major Yang == Sun       == Heart             -> Homeopathy
Minor Yang == Stars     == Acupuncture Points -> Acupuncture
Major Yin  == Moon      == Intellect          -> Homeopathy
Minor Yin  == 5 Planets == Five Hsing         -> Acupuncture
```

This differentiation of the Clearing within the social/reflexive system produces two dual therapies Acupuncture and Homeopathy. Acupuncture deals with the Acupuncture points on the surface of the body and the Five celestial organs within the body. Homeopathy uses tinctures of substances that cause symptoms to cure symptoms on the level of emotions (heart) and the level of intellect. But we can translate these two dual celestial therapies that accept and deal with unseen causation of imbalance from the point of view of the social autopoietic system and the clearing at its heart. The clearing of differentiation at the heart of the social autopoietic system is supported by the Body which represents embodiment. The therapy that would be the dual of the celestial therapies is massage. We note that the body is divides into regions of Earth, Air, Fire and Water elements.

```
FIRE      == Head      == Eyes
AIR       == Chest     == Nose
WATER     == Stomach == Mouth
EARTH     == Bottom    == Chin
```

There are also four basic massage motions related to the four elements:

```
FIRE  == Finger Tips
AIR   == Cupped Hands
WATER == Side of Hands in swimming motion
EARTH == Kneading motion with base heal of hand.
```

Thus the body is always embodied through the four elements. These four elements interact with the five Hsing to produce twenty archetypal interactions of celestial and terrestrial. The Five Hsing is the very image of a hyercyclical Autopoietic Ring. The Five Hsing have production and control sequences which allow it to start and stop the twenty basic interactions. These interactions produce flowing energy that moves through the Acupuncture points. The energy flows were traditionally modeled by soliton waves in canals. The opening and closing of gates allowed the soliton energies to flow around the Acupuncture meridians that formed a mobius strip looped across the body surface with the crossover point just below the nose. It was traditionally understand that sometime when we were children the crossover point had its flow stopped producing two independent dissipative loops operating independently in the body kind like our modern understanding of the right and left sides of the brain. Also we are given at birth a certain quantum of energy that we use up until we die. That quantum of energy is the reflection of the soul in the Body where the soul is seen as the unseen cause. The Chinese traditionally saw the soul

as twofold as it was reflected in the body. The Jing is analogous to our biological concept of enzymes that form hypercycles that regulate cells. We are given a discrete limited amount of enzymes that we use throughout our life. The Chi moves through the Meridians not as a flow but in instantaton like jumps from Acupuncture point to acupuncture point. The acupuncture points are the locuses or junctures between desiring machines. They form a constellation of embodied energy trigger points across the surface of the embodied autopoietic system. Their arrangement and interconnection reflect human ordering or Li. Between them moves the Chi that has a discrete quantity given to the autopoietic system at birth. Thus Acupuncture looks at the Minor Yang and Yin aspects of the embodied Autopoietic system at the second heuristic level.

Homeopathy looks at the Major Yin and Yang aspects of the embodied autopoietic system. Within the clearing there is a differentiation between Heart and Intellect as separate from the body. The Greeks saw Thummos as separate from Gastros. Thummos was noble heart that led to heroic deeds. Gastros was the drive of human needs. Again this problematic distinction (like that between logos and physus) needs to be collapsed together. In Old English we had the word MOOD that meant the unity of Heart and Mind originally. Heart and Mind are clearly a unity that becomes differentiated in our society into a dualism where Mind attempts to reign over Heart. Instead we should see that Heart and Mind are a unity which only appears to be differentiated. But that differentiation reflects the fact that within the social autopoietic system seen from one aspect there is a center or radiance which gives light to the world and seen from another point of view this radiance is reflected off of a source outside the social autopoietic system. The radiance is Yang, the unseen cause, which is the source of light that lights up the world and illuminates the things in the world. When it appears out of the system itself then it is seen as Yang and when it is seen as out of an external source then it is Yin. But no matter where we see that source from the light is always Yang and the reflection of that light is always yin. It is this light that appears within or is reflected within the social autopoietic system that illuminates the world and makes all things visible. It only appears from out of the social when it achieves an autopoietic formation. This is the other way of looking at the autopoietic system via the fundamental celestial therapies.

Homeopathy takes materials from the physus and attempts to heal the logos by transmuting them from gross to subtle with the understanding that subtle things act opposite their gross forms. Thus substances are proved by giving them to healthy

persons and seeing what symptoms are produced. Then these same substances are potentized and made subtle and given to humans with the same symptoms. The symptoms in the human patient cancel with the symptom producing properties of the subtle substance. An important point is the potentization reverses the properties of the substance and thus produce the dual in the subtle form and it is this de-materialized dual that cancels with the regime of disease that produces the same symptoms in the patient. Here we see a form of therapy based on the distinction between physus and logos which developed in the west as an alternative to Alleopathic Medicine that treats for the most part symptoms with medications that produce opposite symptoms. In other words Alleopathic medicine works with external cancellation of symptoms while Homeopathic medicine works with internal cancellation of symptoms. When we transfer this to the Chinese model and get rid of the bias of the Physus and Logos split we find similar principles operating in Chinese Herbology. Chinese Herbology attempts to repair imbalances in Yin and Yang within the body by combinations of Herbs that have Yin or Yang properties. In that science the balanced states of Major and Minor Yin and Yang are augmented with two diseased states Closed Yin and Yang Splendor. These two extra diseased states are nihilistic opposites. Chinese Medicine seeks to bring these diseased states back into harmony and balance. For instance the Positive Fourfold is an example of Yang Splendor and the Negative Fourfold is an example of Closed Yin. These opposite positive feedback regimes are broken by growing their opposite within them. This is to say that within Yang Splendor there must be some counter balancing point of Closed Yin and vice versa. When the opposite polarity is increased to become the same size as its nihilistic opposite then the nihilistic regime vanishes through cancellation. This understanding of how to grow the immanent opposite to cancel its dominant opposite is exactly the same science as Homeopathy attempts to explore within the realm of the physus/logos split. The problem is that the physus/logos split is itself a nihilistic opposition so that homeopathy cannot fully correct the bias that is built into our worldview that says the material is dominant over the immaterial or vice versa instead of recognizing the balance between the two.

We see here that the Autopoietic system has been understood by the traditional Chinese Sciences for thousands of years. Most of the "inventions" that the West prides itself on were previously discovered sometime in Chinese scientific history. And Chinese Science perfected the definition and exploration of the world in terms of autopoietic formations. We are slowly arriving to the point were we can appreciate the advances of Chinese Science today which were so far beyond

Western conceptions of systems that we did not recognize them as systems theories. Similarly there are aspects of Islamic Sciences that similarly treat the autopoietic systems. Their view of the world was based on the understanding that the special systems outlined in this paper existed and had an internal harmony that could be exploited to achieve balance and maintain balance within the system.

If we go up a level we see similarly that there is a heuristic that covers the Clearing at the center of the Social Autopoietic system which involves the identification of eight permutations of Yin and Yang. This level is related to the Trigrams of the I CHING. Basically these Trigrams have a qualitative and an quantitative aspect which are permutated to give sixty four permutations. These sixty four permutations revolve around the twenty archetypal interactions between heaven and earth. We can see them if we extract reversibility and substitution from the sixty four hexagrams. Thus the sixty four hexagrams delimits the social level in its quantitative and qualitative aspects. It is interesting that the I CHING was the basic template for Chinese Society for thousands of years. It has the same structure as DNA. It is in fact the DNA for society delimiting the sixty four basic social states and their transformations via a ring structure of dual operations.

The eight octaves are merely the quantitative aspect of this set of Trigrams. The qualitative aspect can be seen in the I CHING and its definition of the Trigrams. I is interesting that the LO and HO river maps are exactly this relation between quantitative and qualitative aspects. The HO river map is a magic square of nine which is the N^3 where $N=3$ level. On the other hand the LO river map is 2^N where $N=3$ that portrays the qualitative aspect of this heuristic level. The combination of these two maps gives the full 64 permutations of Yin and Yang that the I Ching embodies. The I CHING is the basic structure of the clearing within the social autopoietic system. Other higher heuristics are possible but this is the fundamental threshold of complexity that embodies the fusion of quality and quantity within the social level of existence.

10. Artificiality

o Artificial Static Systems

Formal systems are used to give static pictures of systems. We can use proofs within formal systems but time is excluded and so they have limited value.

o Artificial Dynamic Systems

Structural systems are used to give dynamic models of our gestalts of object systems. The structural and the modeling of changes in structures is the limit to which we can go in producing movies of dynamic systems with explanatory value.

o Artificial Ordered Dynamic Systems (dissipative systems)

When we consider the interaction of ordering principles instead of the systems that they are ordering we are able to go one step further than we can go with a general dynamical explanation. These only apply to a very narrow range of systems called dissipative systems. These systems exhibit growth as the ordering system advances its boundary and the ordering within the boundary becomes overdetermined and generally more complex.

o Artificial Living / Cognitive Systems (autopoietic systems)

The jump from dissipative systems to autopoietic system is from one which orders itself blindly and disorders its environment to one that orders itself intelligently and projects order on its environment as well. At this level we could talk about a feed back/feedforward loop of ordering. The feedback loop of ordering we call life. The feedforward loop of ordering we call intelligence. Autopoietic systems are always Living and Intelligent is an inseparably fused way. Artificial life (A-life) and Artificial Intelligence (A-Life) go hand in hand and to model an autopoietic system you must model both together. Separating them produces something less than living or less than intelligent. This is because cognition is always embodied and life is the embodiment of intelligence.

o Artificial Social Systems (reflexive systems)

Artificial Social systems are the foundation of AI and A-life systems. You cannot have intelligences that are not founded on social bases just as you cannot have life that is not social. If it is not social externally then it is social internally. Even if it is a single cell the relations between the autopoietic nodes within it is social. Those nodes display intelligence and life through their interaction. Life is not just in one place within the cell. Intelligence is not just in one place either. These three emergent properties are all interrelated and diffused throughout the cell. However, we can look at the cell as if it were merely living and not intelligent. Or we can look at it as if it were intelligent but not living as we do with neural networks. Or

we can look at it as if it were social in its interplay of different pieces to cooperatively accomplish living or cognitive functions. But the true nature of the cells intelligent and social aspects do not become apparent till you see the cell operating with other cells. Then you realize that cells socialize as organisms that have special intelligent sub-functions. And you realize that when organisms cooperate together even higher intelligences become apparent and the social aspect becomes even clearer. Thus we need to discern the social aspect of living/cognitive systems an model that as well in our artificial simulations that seek to elucidate these characteristics of these specialized systems.

It is the role of computational sociology to build models of artificial social systems. Its goal should be to simulate Artificial Intersubjectivity (A-IS) as envisaged first by Ben Goertzel in his book <u>Chaotic Logic</u>. This is possible because symbolic interaction must be computable. If it was not computable society could not exist as a functioning organization. Computational Sociology looks at the minimal structures that would simulate the functioning of social relations between autopoietic systems. We have seen that turing machines define what is computable and turing oracles increase that definition. Universal turing machines allow us to simulate arbitrary symbolic manipulation using multiple turing machines. When these turing machines are sharing tapes and interacting across tapes as communications channels then we get distributed artificial intelligent systems that form social relations. It is not that sociality arises from distributed artificial intelligence but instead that sociality is the presupposition that allows distributed artificial intelligence to arise. Computational sociology turns the tables upside down and posits the social which means the emergent as the fundamental basis out of which arise autopoietic systems interacting in distributed configurations. Sociality must be built in and modeled from the beginning. From the social arise the distributed artificial intelligence and the ecosystems of artificial life. We need to simulate the social directly and show its basis in the computable as an extension of turing machines into higher levels of turing machine interactions which track the unfolding of dissipative autopoietic reflexive systems.

We go further to say that there is an element of intelligence that is not captured by Artificial intelligence and an element of life not captured by Artificial life and in each case that element is its interface with the social. This is shown within AI by Minsky's concept of the <u>Society Of The Mind</u>. There is something beyond differentiation and cooperation of distributed independent processors which cannot be captured by these concepts and modeling techniques that make the mind what it

is. That missing ingredient is the social aspect of the mind which gives rise to the independent differentiated cognitive elements as their origin. Similarly there is something within life that is more than just the individual living unit that can only be captured when one looks at evolutionary dynamics that presuppose social dynamics. The missing ingredient within artificial life is always the social aspect where organisms interact and in fact are generated out of an origin in the social. In both cases our simulations of intelligence and life will always be missing something as long as they do not include the social as an integral aspect of their functioning.

Computational Sociology must in turn be dependent on Autopoietic Sociology which sees the hierarchy of special systems we have been outlining as the axis around which the modeling of all cognitive/living systems revolve. Autopoietic Sociology looks for examples of emergent events and reflexive autopoietic systems within society and its mirror image social psychology. Autopoietic social systems are very rare formations which are the foundations of all social and psychological phenomena. In other words pure autopoietic social formations are unique are rare instances that by their existence make possible other less unified social and psychological formations. Autopoietic sociology and social psychology look for these rare formations and relate other social and psychological formations to those. Computational Sociology uses this theory to construct computable simulations of the social both in its ultimate form as social autopoietic systems and in lesser forms that are based on the ultimate form.

The dual of Computational Sociology is Social Phenomenology. Social Phenomenology relates the series of special systems to human experience and ultimately becomes a phenomenology of mundane love and its degeneration into romantic love and nihilism. Social Phenomenology is an extension of Existential Phenomenology into the social domain which relates phenomenological structures to the social following Alfred Schutz but realizing the connection to social autopoietic systems as the foundation of all phenomenological structures. In other words it is the very rare social autopoietic structures that are the basis of all phenomenological structures. Those rare structures are exemplifications of mundane love in marriage which degenerate into romantic love on the one hand and non-love or nihilistic structures on the other. The non-love or nihilistic structures have been the traditional hunting ground of phenomenologists who explore the anxiety of the individual on their own and isolated. Few phenomenologists have explored the structures of love and then those who have used romantic love as their touchstone. In other words they have gone to the opposite extreme away from

nihilism (too little meaning) to the extreme of too much meaning. As yet no one has explored mundane love in marriage as a phenomenological structure. It is mundane love in marriage that can assume the shape of autopoietic formations that become the central structure on which all social relations are built. Social Phenomenology explores these all to human structures and relates them to the possibility of the emergence of autopoietic social formations such as those symbolized by the marriage of Odysseus and Penelope within our tradition.

Computational Sociology is the non-human image of the pure autopoietic social formation in a simulation. Social Phenomenology is the human image of the autopoietic social formation as it is embodied in mundane marriages. Marriage is an unpopular institution in our culture at this time. Marriage is being attacked from all sides within our society. However, marriage is the archetype of the autopoietic social formation. Why? Because it is an invisible bond between kinds of a kind (i.e. between male and female of the human kind). That invisible bond is sociality and the source from which social beings and social relations originate. From the beginning of our tradition the household based on marriage has been counterpoised in relation to the City. If other autopoietic social formations are possible then they must be compared to this traditional social formation. And this social formation needs to be compared to all the derivative social formations that emanate from it including the City or State formations. Deleuze and Guattari in <u>Anti-Oedipus</u> have given one such analysis. Sartre in his <u>Critique Of Dialectical Reason</u> has given another related analysis. More such analyses are needed now that the basic structure of dissipative autopoietic reflexive systems have been elucidated. In T<u>He Fragmentation Of Being And The Path Beyond The Void</u> the author has given a genetic analysis of the roots of this formation. That study is subtitled "Speculations in an Emergent Onto-mythology." Onto-mythology is the study of the genetic roots or our worldview and looks at the relation between the household and the city as primal interdependent social formations. Specifically it looks at the Second Best city of Plato's <u>Laws</u> as an archetypal systematization of the autopoietic social system. Onto-mythology is which looks at the roots of Autopoietic Sociology is the final discipline that needs to be added to the other three already defined to give a complete picture of our own worldview as an autopoietic social formation.

11. Conclusion

We have explained how general systems theory is extended to cover three special systems theories which approximate the dissipative, autopoietic and reflexive

systems through their analogy with the complex, quaternion, and octave number systems and their algebras. This presents a new paradigm for which rethinks General Systems Theory in terms of specialized systems theories involving order production, life, intelligence, and society. It discovers that there are specific thresholds of complexity at which these different systems arise unfolding from each other which have analogues in the mathematical theory of algebras. Each of these thresholds of complexity are steps from General Systems Theory toward the definition of the social. This new paradigm gives a mathematical basis to the definition of living systems and social systems for the first time. It allows us to create a genuine extension of autopoietic theory into the realm of the social and thus resolves one of the problems of autopoietic theory (i.e. how it applies to the social phenomenal emergent level). It also allows us understand the relation of autopoietic systems to their underlying dissipative systems.

In the course of the paper the disciplines of Social Phenomenology, Computational Sociology, Autopoietic Sociology and Onto-mythology are defined and related to give multiple approaches to the field of dissipative autopoietic social systems. An inherent simplicity with a specific mathematical harmony and differentiation is discovered to underlie these diverse phenomena which connects them to each other as different emergent levels that arise out of General Systems Theory and extend it into the realms of these specialized systems theories which explain the basis of some of the most important phenomena in the universe. The inherent complexity of these phenomena is also explained in relation to their simple foundational structures which are analogous to algebras.

12. Acknowledgments

This is the first in a proposed series of papers which would treat each level in more detail. This first paper attempts to set out all the interconnections between different emergent levels and the other papers would treat each level in detail working out the connections to the algebras associated with the dissipative, autopoietic and reflexive

emergent special system levels.

Thanks go to Ben Goertzel for continuing correspondence concerning the ideas expressed in this paper. This paper attempts to answer some of his critiques of these ideas and attempts to present further developments of these ideas based on his analysis and reformulations by which he has attempted to understand my expositions of what I have perhaps too soon called a paradigm shift. His interest in these ideas have spurred me on to try to express them better and to give firmer grounds for substantiation. This task has just begun but without the interest that he has shown I would not have been able to make what progress I have in clarifying my thinking and the basic argument of the mathematical analogies to special systems theories that emerge from the consideration of General System Theory (GST). I have also been inspired by George Klir in who's exposition of GST I have found the basic point of departure for my understanding of Software and Systems Engineering Design Methods which started me on this journey to better understand GST and its relation to the theory of Autopoiesis. I would also like to thank Leonard Woo who helped critique the ideas as they were being first developed. I would also like to mention Larry Broberg who along with Bob Cummings and others from Rockwell AESD has served as a sounding board for these and similar wild ideas. Also I would like to thank all the virtual friends I have made on the Thinknet systems theory and Dialognet philosophy electronic mail lists emanating from majordomo@world.std.com. Special thanks also goes to my mentor and teacher Ian Dallas.

===

Draft #2 961206 Editorial Copy.
Not for distribution.

The original is available on web pages associated with the DialogNet homepage is available at http://dialog.net:85/homepage/ or in the Dialognet BBS which can be accessed by telnet at dialog.net.

Keywords:

General Systems Theory, Ontology, Meta-Systems, Dissipative Structures, Autopoesis, Reflexive, Social, Worlds