

Steps To The Threshold Of The Social

PART 6: Emergent Meta-Systems

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1. Preliminary Sketch

This essay will attempt to describe Emergent Meta-systems in a semi-formal way in order to pave the way for building Artificial Intersubjective (A-IS) Simulations of this new kind of entity. The departure for this enterprise comes from the work of Ben Goertzel who defined Self-Generating Systems (SGS) as opposed to the Component Systems (CS) that were defined by Kampis. Goertzel defined SGS in his book Chaotic Logic where he reviewed Component Systems and showed the difference between those and Self-Generating Systems. A subsequent study of SGS and CS has led the author to propose a further formalism based on SGS called Emergent Meta-Systems (EMS).

Goertzel also proposed, we think for the first time the concept of creating Artificial Intersubjective Simulations complementary to Artificial Intelligent and Artificial Life simulations that have become so important recently. It is a natural extension of these to begin to consider the social ramifications of Artificial Intelligent and Living Systems. This realm has already been opened up by Distributed Artificial Intelligence. But there the emphasis is on the cooperation of independent artificial intelligent agents. Rather artificial intersubjective simulations focus on the social foundations of the Society of Mind from a cognitive point of view and of the social relations between autonomous beings from the viewpoint of Computational Sociology. In this we hope to continue the advances that have begun to be made by

Hubermann in Computational Physics and of Kauffman in this studies of Computational Theoretical Biology. Each of these disciplines have turned their attention and efforts to understanding human organizations from the point of view of complex systems analysis. What we would like to see is the creation of a discipline which begins from sociological principles that recognize the *sui generis* nature of the social but that applies computational techniques to the exploration of complex social organizations. Through computer simulations we can explore complex sociological systems starting from sociological first principles. It turns out that the development of such approaches is of interest not just to sociologists but also to other disciplines. For instance, those that study artificial life realize that the artificial organisms must interact in an artificial ecology with each other to produce artificial societies. Those that study artificial intelligence also are interested in how distributed artificial intelligent agents will cooperate to solve problems to complex for any one agent to handle. Those studying cognitive psychology wish to understand how distributed cognitive functions cooperate to create the Society of Mind. In fact, this is how Goertzel who is a cognitive psychologist came to first to propose artificial intersubjective simulations. However, we wish to found these simulations on sociological principles that recognize that social organization has a reality of its own that is not reduced to any other level of organization. In other words we want to show that when agents of a special type are brought together social relations appear as emergent properties and that in turn these emergent properties give rise to the emergent properties that define the individuals within the social sphere. Rather than creating individuals that are asocial and attempting to combine them to create social relations, we want to see social relations emerging as a *sui generis* phenomena and then we want to see the individuals constituted out of this social primal soup rather than starting with a monodology.

This leads us to consider Self-Generating Systems proposed by Goertzel as the special kind of agents out of which the social primal soup is constituted that in turn lead to the advent of social individuals. We are turning up side down the conventional wisdom that individuals come first that then create social contracts between themselves. Instead we are following the lead of Merleau-Ponty who recognized that there can be no individual without the prior existence of the social relations of mother and child. When we look at individuals development we see that each of us arise out of a web of pre-existing social relations that we do not as children understand but take for granted. Without these pre-existing social relations we cannot become individuated cognitively rational beings negotiating the social landscape. Thus we see Social Phenomenology as the empirical basis

Computational Sociology. A social phenomenology takes the problem of intersubjectivity in phenomenology as its starting point rather than existential individuals. In this we follow the lead of Statler who in *EXISTENCE AND LOVE* shows that a social phenomenology is primal. What we want to do is find a formalism that allows us to express the basic social fabric computationally and then allow individuals to arise to interact within that social fabric. We support a basic approach the like that found in the work of Coutu who posits that the basic structure of the social fabric is a Tendency in Situation (TINSIT) rather than individuals.

An approach has been found to constructing the social field as a primal foundation for our social simulations. That approach dovetails with Goertzel's positing of SGS as a basic construct in interesting ways. First we posit that there is a complementary relations between systems and meta-systems. We do not believe that it is possible to subdivide systems into sub-systems and sub-sub-systems analytically. Instead, each system has associated with it a meta-system which is a deconstructed system whose parts float in a field of propensities toward each other. Those parts can in turn be seen as systems that in turn are deconstructed into meta-systems at a different level of abstraction. Thus the system and the meta-system are seen as ontological emergent levels within out social phenomenology. There are a whole series of these levels of coherence of which systems and meta-systems are only two. For instance there are at least the following levels:

Figure 215:

Fragments*		
Monads*		
Structure	Primitive	Pattern
Form	Object	Shape
System	Gestalt	Explicit Order
Meta-System	Proto-Gestalt	Implicate Order
Domain		
World		
Universe	Kosmos	
Pluriverse		
*Note: not explained here.		

We note that Husserl's Phenomenology described only one of these coherent ontological levels which was that of form. It was Gurvitch in *THE FIELD OF CONSCIOUSNESS* who added the basic concept of the Gestalt as a way of viewing things within consciousness. In the Social Phenomenology we posit that there is an emergent hierarchy of such levels of coherence of which form and gestalt are only

two. In this essay we will focus on the System and Meta-system levels. When you move between the system and the meta-system level it is as if the system becomes deconstructed into a field of parts upon the gestalt background rather than being a figure on the gestalt background. When we move between the meta-system and the system then we are constructing and designing a system so that it can be an synergy of parts that is coherent.

In our attempt to understand the the meta-system level of coherence we take as our example the operating system in relation to the applications that exist within its milieu. The operating system should be recognized as a meta-system not a system. It is in a way an inversion and generalization of the systems that it contains as applications. Another more formal example is the Universal Turing Machine (UTM) in relation to the Turing Machine (TM). A UTM is an operating system for the expression of Turing Machines. Turing machines are encoded on tapes that are read by the UTM and embodied just as an application is read into memory by the operating system and given the resources it needs. Meta-systems have two basic aspects. It can be seen as either origin and as an arena. As an origin it gives rise to the systems that appear as parts that appear in its field. As an arena it supports the communication and interaction of these parts. The systems in the arena cannot stand alone. They are partial to the extent that they need the meta-system operating-system in order to exist at all. The meta-system is also partial in that it does nothing useful on its own. It has a lack which is exactly fitted to the kinds of systems that inhabit it. The systems on the other hand have a surplus. Systems are wholes greater than the sum of their parts. Meta-systems on the other hand are wholes less than the sum of their parts. Meta-systems always have a lack that the parts of the system fit into. Systems always have emergent properties that disappear when they fall apart into meta-systemic fields. When we move back and forth between a system and a meta-system the emergent properties appear and disappear. Thus when we look at artificial cognitive and living systems simulations the key point seems to be to engineer meta-systems that under special conditions produce the right global emergent properties and become systems. This is the approach of Kauffman in The Origin Of Order and At Home In The Universe. He wishes to produce auto-catalytic systems that have holistic properties. To him Life is a global property that emerges in complex molecular systems spontaneously. He calls this phenomena "order for free" and says that it is just as important as Selection as the foundation of evolution. Similarly Distributed Artificial Intelligence (DAI) systems attempt to solve problems that no one intelligent agent can solve by themselves by getting those agents to cooperate. Thus the global solution of a hard problem is an emergent

event that appears out of the cooperation of the different kinds of intelligent agents. The key as in Cellular Automata is go get global properties from local interactions. This in our terms means traveling from the Meta-system to the System. The idea is to stack the deck so that the desired effect appears as if on its own accord.

We can however see that it is also possible to travel from the system to the meta-system. In such a simulation we would build systems with global emergent properties and take them apart watching those properties disappear. This is currently called deconstructionism. And in fact this is the situation we are normally faced with in the kinds of Software and Hardware systems that we build all the time. We attempt to build systems with global properties but see them deteriorate and fall apart so that the global properties disappear, as when we find bugs and other problems that prevent the system from operating as expected. Therefore we see that the novelty of the transition from meta-system that appears as a trend in Academia is merely the obverse of the trend in system building that occurs in Industry. We would not think of taking a constructivist approach in industry to building systems. In other words no one would think of creating small agents and hope that when we put them together they would give the global properties we desire. Instead what we do is start with requirements for global properties and attempt to build systems that fulfill those requirements. What this means is that our Software and Hardware systems are very fragile. If any part goes wrong then the global emergent properties disappear. This is very disconcerting. Thus we attempt to address this problem by building in redundancies. But this takes us back toward the ultimate redundancy where every agent which the system is build out of was replaceable and where the global properties would appear given any population of agents. Thus constructionism would give us the ultimate robust systems if we knew how to grow populations of agents that would produce any desired emergent global property. But as it is we do not know what emergent global properties any particular agent type will produce. So we are stuck building fragile systems that are specially constructed to display the required emergent properties.

The question is whether there is any other approach that will help us create robust systems with desired emergent properties coded into the agents at the lowest possible level? This is a very difficult question. But what we see from the above is that using meta-systems and relating them to systems gives us a way to think about Social simulations. The social field can be seen as a meta-system within which partial systems appear. These partial systems can be constructed into individuals who are like the systems with the desired emergent properties of interaction. For

this approach to make sense we need to develop a social ontology similar to that of Deleuze and Guattari in Anti-oedipus. In their social ontology they posit that the individual is an illusion made up of desiring machines suspended in the field of the socius. Desiring machines are what psychoanalysis calls partial objects made popular by the objects relations school of psychoanalysis developed by Kline. The individual is an illusion created by the interplay of desiring machines as they interact within the field of the socius. The desiring machines appear as orthogonalities out of the unconscious which is called "the body without organs." We differ from Deleuze and Guattari in that we do not de-value the level of the individual giving priority to the other levels but recognize that all three of these levels have an important role and that together they make it possible for individuals to appear as conjunctions of desiring machines within the meta-system of the field of the socius. This means among other things that individuals may share desiring machines and that various individual systems can be constructed by reusing the parts that appear floating in the field of the meta-system. Individuals interpenetrate thorough the reuse of the partial systems within the meta-system.

Once we have the idea that individuals as systems overlap sharing parts (desiring machines) and are embedded in the social field then we can see it is possible to move back and forth between system and meta-system views of the individuals interacting within the meta-systemic field. In fact each of these levels co-exist. The social field exists as the meta-systemic field that connects the parts of the individuals in a web of propensities (TINSITS). The individuals exist as sharing parts and building them up into systems that are wholes greater than the sum of those parts, i.e. exhibiting global emergent characteristics. And the parts appear as desiring machines that have multiple uses to different individuals, that is to say they are reusable due to their embedded synergetic capacity. And this is where we begin to see where the Self-Generating Systems model developed by Goertzel comes in. The SGS elements appear as an excellent candidate for building up a picture of the desiring machine parts that make up the individual. This is because SGS makes the opposite assumptions as Systems Theory. Systems Theory assumes that systems are based on continuities. We define systems as gestalts. A gestalt is a dynamic between figure and ground that lasts over time and is assumed to be continuous. For systems theory the problem is to account for discontinuities that disrupt the flow of the dynamical systems. The best example of a structural formal system's theory is the General Systems Problem Solver of George Klir as described in Architecture Of Systems Problem Solving. Here Klir constructs a structural system (a micro-formalism) that bridges the gaps in the unfolding dynamics of the structural system.

This kind of sophisticated General Systems Theory (GST) can explain the discontinuities within the unfolding of systems. However, though they can be fitted to these discontinuities and can bridge them after the fact they can not generate those discontinuous behaviors a priori. So GSTs assume continuities and can explain discontinuities up to a certain degree. But what we need is the inverse of GST which assumes discontinuities and makes continuities the characteristic that needs to be explained. Goertzel's SGS is an example of such an inverse of the GST. And by assuming discontinuities it makes an excellent rubric for constructing the desiring machines that make up systemic individuals with emergent characteristics.

SGS is defined as a set of elements that mutually create each other. Component Systems by Kampis are a series of Lego like elements that combine to create new configurations which he claims are not computable. SGS goes beyond these by making up a loose set of components that mutually create each other which Goertzel claims is quantum computable. He claims that both component systems and SGS are quantum computable and that can scale down to emulate turing computability. Goertzel produces an example SGS called a Magician System in which a swarm of components mutually create and destroy each other. Each Magician has an anti-Magician as its counterpart and they annihilate each other. The Magician Swarm goes thorough a lifecycle in which they mutually act on each other and communicate creating patterns and then each decides which particular components should exist in the next moment. Each magician nominates the persistent magicians in a special potential space. The nomination of anti-Magicians are a vote against a particular component continuing to exist. Then all the magicians and anti-magicians that are nominated cancel with each other. Those that are left actually make it into the next lifecycle phase to start the process over again. An important feature if Magician systems is that persistence over time by any one magician only occurs through the collusion with other magicians in the nomination and voting process. Voting is done in this case though the annihilation of opposite magicians. What this characteristic means is that sociality is an in-built characteristics of magician systems. Also since magician systems reconstitute themselves at each life cycle revolution they do not assume continuity but instead the formalism assumes the discontinuous cycles of creation and destruction that model a punctuated equilibrium kind of evolutionary model. Persistence and continuity need to be explained by showing specific collusions between magicians to keep some feature of the swarm in existence from one lifecycle revolution to the next. This combination of assuming social characteristics in the Swarm of magicians and the non-assumption of continuity makes magicians an excellent

candidate for modeling desiring machines as segments of individual systems that continually reform as a swarm to provide a substrate to the illusory continuity of individuals within the social fabric. The social fabric is constituted by the collusion of magician SGS components. The components themselves in their swarm can be seen as modeling desiring machines. And the continuity of individual systems made up of sets of components within the swarm must be continually explained on the basis of the social interactions of the lower level components. Thus the individuals arise as emergent global properties from lower level partial components embedded within a social field.

Our next step is to go beyond the dialectic of systems and meta-systems to realize that some very peculiar and strange special systems may exist that balance between the characteristics of systems and meta-systems. As we have said systems are wholes greater than the sum of their parts in which emergent properties appear. Meta-systems are less than the sum of their parts contain a lack sculpted for the inclusion of system parts in a field of propensities. But also there exists a third possibility that arises in very specific and rare situations in which the whole is exactly the sum of the parts. We wish to use the special systems to construct a further type of SGS which we call emergent meta-systems (EMS). We note that Goertzel's SGS formalism does not seem to allow for the emergence of a genuinely new eventuality (event/entity). An emergent eventuality would be a new instance of a new kind of individual that is orthogonal to the already existing possible components of the swarm. Goertzel's formulation of SGS is dependent on an interpretation of randomness that does not distinguish between a random pattern and a pattern whose complexity of patterning is beyond our ability to recognize. Thus the SGS does not seem to preclude the existence of Emergent eventualities but his formalism lacks the specific aspects necessary to include emergent events as a positively described part of the system. Therefore we think it prudent to make the extension of SGS to positively describe the possibility of emergent meta-systems.

Emergent Meta-systems take full advantage of the existence of a third way of describing systems between the alternatives of systems and meta-systems. Emergent Meta-Systems embody the special systems that appear in rare situations but have special properties the most unusual of which is their ultra-efficiency. EMS is an extension of SGS which is in turn an extension of Components Systems of Kampis. We claim that EMS is also quantum computable as are SGS and CS but that they are not turing computable. However, in order to understand the quantum computability of EMS we will need to look at precisely what quantum

computability means as it necessitates bringing other mathematical formalisms representing propensity and possibilities together with probabilities in order to create a more robust picture of quantum computability. This we will attempt later in this essay. For now it is necessary to review the nature of the special systems in order to get a better picture of Emergent Meta-systems.

Systems and Meta-systems together define a "design landscape" which is full of wicked constraints that make the mapping from the meta-systemic parts into the system very difficult. Many times there are constraints in this design landscape that render difficult to achieve certain types of efficient solutions and make ultra-efficient solutions impossible. Emergent eventities may be seen as revolutions in which things that were hitherto impossible, or merely un-thought of or unheard of suddenly become possible in a new context. The arising of the emergent eventity causes us to rewrite not only history but also the possible futures as G.H. Mead points out in the Philosophy Of The Future. There Mead basically identifies the Social with the ability to generate and respond to emergent eventities. We will look upon the design landscapes spoken of just now in terms of the NK type models of Kauffman which show us fitness landscapes. We will consider EMSs to be coevolving swarms with mutual dynamic fitness landscapes. Emergent eventities occur when the fitness landscapes mutate rather than evolve as some genuinely new possibilities cause the maps to change radically. Artificial emergence is when new things come into existence merely but the sudden combination of factors (genes) that have not been combined before. Genuine emergence is where the actual language of the genes are extended due to the appearance of new hitherto impossible or un-thought of possibilities changing the set of factors that can be drawn on to create the combinatorial map. Each EMS component produces a fitness function rating all possibilities. So for each point on the NK landscape there is a series of fitnesses related to each component in the swarm. The whole swarm co-evolves except by the rules of the SGS not by the rules of Component Systems. This means that discontinuity is assumed instead of continuity as the fundamental substrata of the system. These two elements 1) the assumptions of discontinuity using the SGS formalism instead of the Component System formalism that was developed by Kampis and implicitly assumed by Kauffman and 2) the ability of new genuine possibilities to appear mutating not the components but the map itself are what distinguishes Emergent Meta-systems.

However, EMS also are based on special systems instead of systems or meta-systems. SGS and CS are specifically thought of as SYSTEMS not as Meta-

Systems or Special Systems. Special Systems are build up of conjunctions of elements in a particular hierarchy that is isomorphic to the alternating division algebras. They perfectly balance themselves between surplus and lack and can manifest only in very special circumstances. The first level of the special systems are called Dissipative Structural Systems. They were pioneered by Prigogine and discussed at length in his book Order Out Of Chaos. These special systems can be seen as analogous to the the algebras of the real and complex numbers taken together. If we consider that every system is described by attributes that are reduced to variables with some order. And if we consider that most systems aspire to having a real number ordering as the basis of their description. Then what we see is that the same algebra that unites the real number descriptions of dynamical systems over time can include the complex numbers as well. The real and complex numbers must be held in conjunction for this extension of the kinds of numbers to occur within the algebra that covers both types of numbers. The difference between these types of numbers cannot be distinguished outside this conjunction. This means that the special property of complex numbers as distinguished from real numbers vanishes if they are taken out of conjunction even for a moment. Conjunction is a special kind of addition that is never completed which holds the variables apart yet together. The vanishing of the global property that distinguishes the kinds of numbers can be seen as an annihilation (in physus) or cancellation (in logos). Thus the meta-systemic operation that appears at the first algebraic level is cancellation or annihilation depending on which end of the dualistic interval you project the operation onto. Magician SGSs have the difference between magicians and anti-magicians that annihilate or cancel as a fundamental operation.

Kauffman speaks of catalytic action. We can clearly see that catalytic action has the general form of the dissipative structural system. A catalyst is something that does not participate in a reaction but makes the reaction between molecules more likely or speeds it up. Therefore by using catalysts we can control reactions creating pattern of transformations that would not appear otherwise. But the catalyst is aloof from the actual reaction and remains unaffected by it unless there is some counteracting catalyst that effects the catalyst itself. When their are chains of catalysts that effect each other's production then what is created is a hypercycle. The hypercycle causes negative feedback within the circuit of reactions within the system. When a hypercycle forms then we have a autocatalytic closure. The closure is in terms of the meta-reaction control ring. But when we analyze Catalytic action we see that it involves an ordering from nowhere as do all dissipative systems. Kauffman talks about order for free or spontaneous order but does not say exactly

how this works or how it suddenly appears. But we can look at the Catalytic regime to see that it is an ordering from no where. In this case there is a soup of molecules which is assumed to be within four dimensional spacetime. However, within the soup the difference between catalysts and non-catalysts sets up a fundamental distinction that is equivalent to a dimensional difference. The catalyst moves across the dimensional difference to effect something on the other side that cannot effect it directly. It can only be effected by something else that creates a complementary dimensional difference that effects the production of the first catalyst. The fact that two catalysts can form a feed back structure each effecting the other allows reactions to turn on, process to a certain point and then turn off automatically forming a self-controlling process. The fact that several of these feedback control structures can be linked together in a chain or a ring allows complex processes to be controlled and form cycles. Now to the effected reaction the catalyst acts on it as if from nowhere to effect a rate change or to jump-start or prevent a reaction. Some catalysts act on their own production so that if they are not present to some extent more cannot be produced. In this case the catalytic agent and what is produced is the same thing. But still there is a dimensional difference created by its presence or absence. Bateson called these dimensional differences "differences that make a difference." Catalysts create thresholds for triggering reactions or stopping reactions within the soup of reactants. Thus the catalyst is producing an order from nowhere (from the point of view of the reactant) that controls and orders its productive or anti-productive efforts. This is the basic form of all dissipative systems. But normally we think of such system in terms of dissipative structures such as those described by Prigogine. Such structures have a boundary and a singularity at the center. Order that is neg-entropic enters at the singularity and advances toward the border disordering the environment and causing the border to expand. Because the singularity is smaller than the border in every case by definition much more reordering of the environment than it experiences as a disordering occurs than there is ordering poured into the dissipative structural system from nowhere. If we do not realize that a dissipative structural system has a dimensional difference embedded in it then we do not recognize the relation between the dissipative system and the relation between real and complex numbers within the same algebraic system. But what the model of the complexnionic algebra adds is a strange twist like an Escher waterfall by which the disordering of the environment BECOMES the source for the ordering poured into the dissipative structural system thorough the singularity at its center. In other words a potential space connects the source of order and the frontier of disorder so that the one powers the other and vice versa. In this system entropy gives rise to order that in

turn gives rise to entropy in a perpetual loop that will continue as long as there is the right environment for the system to prosper in (i.e. the right food is available). Not a lot of dissipative structures completely fulfill the model of the dissipative system that we get through the analogy with the complexnionic algebras but certain ones do. For instance the soliton can exist only in a trough. The soliton itself is an unusual formation that is held together by the reflection of its partial waves off the bottom and sides of the trough that holds it. Thus in the soliton there is exactly this kind of circulation that causes the central wave to hold together through the reflection off the boundary of the trough. And it occurs that the soliton has very special characteristics that are neg-entropic. Solitons can reflect off walls, pass thought each other, and go on past all our expectations for any wave only stopped by the ending of the trough or friction or some external factor. So we see that the analogy of the dissipative system is fulfilled by the soliton that has ultra-efficient characteristics. We will find exactly the same situation with each special system. It manifests ultra-efficiencies to the extent it perfectly approximates the conjunctive formation of one of the alternating division algebras.

The next hierarchical level that appears with the augmentation of conjunction is the autopoietic system. The autopoietic system is produced by the conjunction of two dissipative systems. This is represented in analogy by the move up from the complexnionic algebra to the quaternion algebra. Suddenly instead of one imaginary number we have three imaginary numbers held in conjunction with the real numbers. This algebra gives us a formalism for depicting the four dimensional rotations that in four dimensional space give rise to perpetual motion machines. Such rotations are blocked in three dimensional space, but their effects can be seen in other phenomena. In fact in autopoietic systems ultra-efficiencies appear that are directly analogous to four dimensional rotations. This is a surprising and unexpected result. But algebraically the move to this level causes us to lose the commutative property. Thus suddenly operations cannot be easily reversed within the algebraic system so mutual actions become very apparent in their asymmetry. The loss of the commutative property causes us to focus of mutual actions which no longer can be reversed simply but are asymmetrical and cause long loops of supplementary actions to be needed to bring about reversals of operations. Of course these systems of operators on components may be called Abelian or non-Abelian depending on whether the order of the application of the operation matters or not. For any two operators when we lose the commutative property the order suddenly does matter. And we are suddenly focused on the mutual actions of the components and the supplements that are needed to reverse the effects of any

particular operation. We will use the formalism called **EVOVING ALGEBRAS** developed by Yuri Gurevitch as a means of embodying our component systems whether they be CS, SGS or EMS. These are 'universal algebras' in the sense that they are entities with operations but without direct relationships. All relationships are reduced to signatures of functions and therefore do not have to be explicitly formulated but can appear as a secondary effect of operations or functions. Evolving Algebras are a generalization of turing machines that can be applied at any level of generalization. So by using the Evolving Algebra formalism we are able to go to the limit of what is turing computable and set the stage for exploring the quantum computable aspects on that basis. Evolving Algebras seem like a natural notation for these kinds of Systems. The operations on the entities allow mutual action to take place that establish dynamic relations between components (entities). But Evolving Algebras allow us to go further and substitute new functions or operations as the system develops. So instead of a state space like that described by Kauffman of embodied feature (gene) combinations we have static algebras as the synchronic representations of our component systems. Then we have explicit rules for the changes between synchronic moments that give us a diachronic picture of the development of the system over time. The operation that comes into existence at the autopoietic level is Mutual Action which is one of the basic operations of the Magician SGS.

Kauffman talks about systems of catalytic molecules and non-catalytic but catalyzed molecules that reach auto-catalytic closure. Autopoiesis is more than just closure but also stability of organization by self-imposed homeostasis of the system. Autopoiesis was described by Varela and Maturana. We posit that Autopoiesis is achieved when two dissipative systems co-evolve and are in active conjunction so that they order each other and thus achieve stasis. This is a condition that goes beyond just the creation of an autocatalytic closure of the system. Autopoietic systems exhibit living/cognitive behavior from which the observer cannot be separated. Merely autocatalytic closed systems still have observer independence as an assumed condition. Where the dissipative structural system is a chiasm of form and pattern production, the autopoietic system is a reversible non-dual chiasm of the living and cognitive characteristics we see in organisms and in cells. As Rescher has taught us our analogy for a System is the organism which he has broken down into a series of properties that go beyond what is usually ascribed to formal systems. Systems are normally reduced to pure forms or objects in formal systems. Occasionally we see formal structural systems such as Klir's seen in Architecture Of Systems Problem Solving. In our way of looking at these kinds of organismic

systems that seems to have the paradoxical qualities ascribed by Bergson in Creative Evolution as 'elan vitale' we see instead machines as do Maturana and Varela, but machines in the sense of Deleuze and Guattari's desiring machines that are non-dual and do not make any distinction between organism and machine. These are very special machines however that exhibit all the characteristics of life and intelligence as global properties and cannot be separated from the observer. We need to view them in a relativistic information regime similar to that developed by Jumarie in System Information And Subjectivity. In such a regime different observers will have relativistic information about the system under study. Observers cannot distinguish the living and cognitive aspects of such special machines. They cannot predict the outcome of any given set of inputs because as well as being autocatalytically closed they are autopoietically closed to outside observation. All observations are interpretations of the homeostatic process of the machine imposing an order on itself.

In physics the example of a system that embodies the form of the autopoietic system dictated by the Quaternionic Alternating Division Algebra is Superconductivity. Superconductivity is a perfect example of an autopoietic system in its structure and it has the obvious ultra-efficiency of zero resistance as a product of that perfect approximation. To the extent that autopoietic systems approximate the form of the underlying algebraic structure they have stronger and stronger ultra-efficiencies. In the case of Superconductivity we have a phenomena that would never been predicted, and is therefore emergent which all theories would have claimed impossible prior to its discovery. It has taken years to reconcile that phenomena with known chemistry and quantum effects. Finally a theory has appeared that explains how quantum mechanics allows such an anomaly to exist. What occurs according to the standard theory is that Cooper pairs of electrons arise which communicate to each other via phonons which are the jiggling of the conductive lattice in which the electrons are traveling. Once Cooper pairs form then they scatter against each other so that they completely absorb each other's energy and create a super particle that is exactly double the mass of the electron. This double particle is just like the conjunction of two dissipative scattering systems. But it forms in such a way that it uses its environment as the communication channel through the agency of phonons or waves in the environment itself to allow the electrons to coordinate their action as they travel through the lattice. The electrons that form a Cooper pair can be very far apart. As they travel through the lattice they in effect warn each other of obstacles so that they actually miss all obstacles and resistance goes to zero. Thus their communication channel using the phonon creates an information

loop that allows the electrons to know the obstacles that are coming up and avoid them. Thus you can see that the Cooper pairs are fused to their environment by the phonon that not only connects the conjoined electrons but also gives them information about their environment such that they do not have to scatter off anything in their environment and they can spend all their energy scattering off each other. This is a very strange situation that is allowed by quantum mechanics but is not predicted by quantum mechanics in fact it has taken much study to see how quantum mechanics could allow such a phenomena. But all particles scatter and have probabilities of being in many states. Two identical particles can scatter off each other creating a closed system (like an autopoietic system). But you would think that such a scattering though it did not lose energy would be blind to the environment. Instead because the two electrons can be seen as exchanging a particle called a phonon that is quantization of the jiggling of the lattice environment of the electrons, it is possible for the electrons to know about the global state of that environment and thus avoid all obstacles. Perturbations go to zero and so the pair of electrons can speed through the lattice with perfect knowledge that allows it to avoid every obstacle. So we can see that an autopoietic system with no perturbations, or rather all perturbations avoided must have perfect foreknowledge of its environment. Thus the closedness of the autopoietic system in its extreme compliance to the quaternionic formation of the algebraic system is an open system. This is of course paradoxical but that paradoxicality is very root of all autopoietic systems. Living autopoietic systems are closed, but experience perturbations from their environment. Thus, they are not as good an approximation to the perfect quaternionic blue print. Still they exhibit an ultra-efficiency that we call life and cognition when viewed from different angles. Life and cognition are really a single chiasmic characteristic that is ultra-efficient. It is interesting to note that the perfect ultra-efficient system is totally closed like the mutually scattering electrons, but also almost psychally open and at the same time fused to its environment to the extent that it uses the changes in the external environment as its means of internal communication. Its openness and responsiveness is so complete that it meets no resistance with its environment because it avoids all possible perturbations. Its internal information processing and communication between dissipative elements is through a global connection with its environment that gives it precognition and a global understanding of that environment. When the environment becomes a circular trough then it sets up perpetual motion for when the environment is closed as well as the autopoietic system then the two mirror each other perfectly. An impossibility suddenly becomes possible and we see in detail the structure of a system that perfectly mimics the quaternionic four dimensional

rotations that should be forbidden in three dimensional space.

When we think about living/thinking organisms using superconductivity as our model based on its link to the quaternionic algebraic structure, we can see strange and beautiful parallels. It is amazing that no one has realized before this that the descriptions of consciousness made by the phenomenologists derive their oddity from the fact that consciousness itself is ultra-efficient in a way similar to superconductivity and four dimensional rotations. However, when we realize that consciousness is ultra-efficient at its foundation that opens our eyes to the media thorough which we experience the world every moment of our lives. Suddenly we realize that ultra-efficiency is our way of life and we deny it to ourselves continually. It is not a rare phenomena but such a pervasive phenomena that we do not recognize because it is literally everywhere we look underlying our every sensation and perception. The whole point of Phenomenology is that we are inside the sphere of a closed autopoietic system. Normally we make a lot of assumptions about what we experience and project a "real" world beyond that closed realm onto the world. This is called by Berger and Luckmann "the social construction of reality." We project then reify and then take back in the designated as real world beyond ourselves. But these processes when bracketed using the Phenomenological methodology developed by Husserl lead us into a strange realm of pure consciousness. And that strange realm has all kinds of odd aspects that we normally gloss over and ignore. It has been said that consciousness is a dream articulated by sensations. We know sensations are perturbations to the autopoietic system. Therefore most of what we see as the world "out there" is actually manufactured "in here." In fact, it is amazing that so much of it seems to bear some resemblance to any objective "designated as real" world that is shared by more than one person. But this is due to the fact that sensation is ultra-efficient. In other words, our connection to the outside world is much better than it ought to be given the number of filters and transformations the data must go through on the way to becoming perceptions and cognitions. In fact, suspiciously it is way better than it ought to be. Look at the detail and exactness of most perceptions in spite of the fact that we are actually filling in most of those details out self based on little evidence.

When Phenomenologists look at consciousness they immediately focus on intentionality. Intentionality means that most objects of consciousness are "of something." In other words we go past our perceptions and the processing of them to the things themselves or the other people themselves and experience them directly. So our experience as Heidegger says is ecstatic meaning ex-static -- that is

out of ourselves. So though we are in a completely closed autopoietic system that we each embody, we actually live our lives "out there" in the world and do not notice that we are boxed in at all. So our experience of the world is directly opposite the reality of our imprisonment a closed system. Isn't this exactly the paradoxicality we find in the superconducting system? Electrons scatter each other but they have an almost psychic understanding of the landscape they are careening through such that they never hit any resistance. So the intentionality of consciousness that throws us outward into the world is the most fundamental fact of the closed system discovered by Phenomenology after it has bracketed the external world and all of our natural presumptions. Next Phenomenology sees that consciousness is not just form and content unmixed as we might expect, but instead mixtures of forming actions and content that either emphasize the actions or the content. The noesis emphasizes the actions and the noemata stress the content. But you cannot have content (hyle) without action or action without content. So we see that patterns and forms are merged within consciousness. This we might suspect because pattern and form are merged in the separate dissipative systems that the autopoietic system is made out of. But what we do not suspect is that consciousness has an ultra-efficiency connected with both the noesis and noema. In relation to the noema what we discover is the open infinity of the horizons of discovery. What ever we turn to we can infinitely explore to any depth desired almost without end except where constraints blatantly appear. How can the horizons of consciousness that we normally gloss over and summarize to ourselves so open and unending? We look out on a forest. We see a certain tree and approach it. We pick a certain leaf and approach it. We look in detail and close at hand at the fractal landscape of the leaf and its own special patterns and qualities trapped in the form that is so similar yet different from all the other leaves. Then we take the leaf and place it under a microscope and explore it at the microscopic level. We can get more and more powerful microscopes going down almost to the atomic level and can imagine other levels beyond that down to the level of the postulated quarks. Or equally we can take steps into a more and more global macroscopic universe of equal depth. These almost infinite horizons that surround every nomina in our field of consciousness is an ultra-efficiency of the first order especially when we consider how real the illusion is that we are actually experiencing the things themselves instead of some constructed virtual world. All we can think is that our consciousnesses are turned inside out and are infinitely deep and that depth is the world itself. Or take on the other hand the noesis side of consciousness that emphasizes the actions of consciousness in grasping and understanding things. The ultra-efficiency that phenomenology discovers in this real are meanings. The world is full of meanings

to an almost infinite depth and those meanings are explored by our cognitive processes. There are not end to those meanings that attach themselves to even the tiniest details of the things we think about and explore. The fact that we normally waste out time with trivia does not subtract that the world abounds with a plethora of meanings that flow from almost every aspect we can think of and those meanings get deeper and deeper the more we explore them. The fact that consciousness is full of meanings that seem to flow out of the things themselves is a superabundance one might hardly expect given most dry cognitive models that people invent. Phenomenology is not a bond dry theoretical picture but an unabashed and honest look at what our consciousness is really like and what it finds are infinite worlds of meaning that are even more vast in many ways from the perceptual worlds we inhabit. Those realms of meaning come somehow from inside us and attach themselves to the things of our world and become our world of thoughts that actually in some instances creates things in the so called real world that correspond to our ideas. And when we compare this to the superconducting autopoietic model we see this mirrored in the perfect information that the electron pair have of their environment that is almost clairvoyant. We too have a superabundance of information about our environment that goes way beyond the information given. These two ultra-efficiencies of consciousness related to the noesis and noema join together to give us a superabundantly rich inner and outer world that goes far beyond what might be expected and is truly a marvel considering that we are closed autopoietic entities actually cut off from the world from the point of view to uninvolved observers. We can only really maintain this stance of the objective behaviorist by lying to ourselves about our own experience and by denying introspection as a valid mode of scientific inquiry. Only by restricting our knowledge about ourselves and by falsifying our own experience and calling it science can we trick ourselves into believing the picture painted by Behaviorism that was so deftly critiqued by Merleau-Ponty in his The Structure Of Behavior. Still we have such notions that we can reduce ourselves to machines. We see it in Deleuze and Guattari's concept of desiring machines and in Maturana and Verela's autopoietic machines. Only the machine models have gotten more complex and paradoxical but the fundamental externalist premise is held intact from the days of Skinner's behaviorism. So our experience is so much richer than any scientific models of ourselves will allow as the evidence of introspection is disregarded and our own experiences glossed over and ignored in the name of Science and Objectivity.

Still we cannot completely ignore this rift. And the rift between model of ourselves

and its experienced reality is so extreme because of the unabashed ultra-efficiencies discovered by Phenomenological research. When you add this to Dialectical, Structural, and Hermeneutical research the other main methods of the Humanities we find the picture gets even stranger and stranger. Ultra-efficiencies abound even in these methods that attempt to distance ourselves from ourselves. When instead we follow the lead of Heuristic Research and do away with distancing methodologies all together we discover the profound depth to our own and other's experiences. The depth and variety of the ultra-efficiencies we call consciousness are incredible and they are all glossed over and ignored as a routine matter of dismissive science trying to do the impossible which is be objective about ourselves. That is the one thing we cannot do. It is ironic that Science strives in one of the few directions we have no unexpected ultra-efficient advantage as it denies all the avenues by which we are helped beyond all expectations. However, by comparing consciousness to the quaternionically based phenomena of superconductivity, we have realized that there are points in which the systems are indeed comparable. And it is not only the structures that are comparable but the strange and unexpected results of the superabundance of ultra-efficient modes in perception and cognition that working with the distorted sensational perturbations builds a world full of meaning and abounding detail and then puts us in the midst of it.

Finally we move to the last level of the alternating division algebras that correspond to what are called octonionic algebras and which we call the reflexive special systems. Here we have seven imaginaries held in conjunction with the real variables. These are balanced by seven quaternions corresponding to each imaginary as a specialized holographic group of imaginaries. When we move to this level of special organization we lose another algebraic property, the associative property. By losing the associative property in the algebra we become focused on the associations between things in patterns within the analogous special system. This means the operator of Gestalt Pattern Formation appears that is the final operator that becomes available in Magician SGSs. The magicians form patterns in their swarm. The magicians recognize their own patterns. This makes the magician SGS social by definition as they are reflexively concerned with their own associations with other magicians. At this level a fundamental distortion appears due to the non-associative properties of the algebra. These distortions have the effect of creating a ground against which non-distortions are recognized as a meta-pattern recognition capability. There are three kinds of non-distortions in the western worldview that are significant beyond all others. These are called truth, reality and identity. Together they form a part of Being in the Greek language. But

when we look deeper we see that beyond being part of Being they each have a fundamental relation to the noumena. The noumena as defined by Kant is the part of the thing that never manifests which is beyond the appearances studied by Phenomenology. That which never appears that is the thing beyond all its appearances is what seems beyond Being. Levinas has written about what is Beyond Being in a book of that name. In effect it describes not what is actually beyond all Being but beyond are normal definitions of Being. Truth, Reality and Identity each relate what appears to what never appears in manifestation. Thus these different aspects of Being stretch beyond the Being of pure manifestation to form a deep picture of the relation between appearances and REALTY, TRUTH or the IDENTICAL. When we look at formal systems these three aspects are seen in our attempts to prove completeness, consistency and soundness. When we look at things that appear and our statements about that then we must consider their determinateness or indeterminateness, their decidability or undecidability and their distinguishability and indistinguishability. Our world is full of things that span the spectrum on all three dimensions between the most indeterminate undecidable and indistinguishable on the one hand to the most perfect formal system on the other hand that is ultimately decidable, distinguishable, and determinate. Unfortunately for us it has been proved that we cannot create an absolutely consistent formal system, and we must doubt that the ultimate in distinguishability and determinateness is possible either given the imprecision of our world. Quantum mechanics more or less is the death knell to completeness as things can be seen as either particles or waves (or indeterminate particles). Distinguishability is confounded by the paradoxes that occur in all category systems that cause us to create multiple category systems for the same sets of things and do not allow us to decide finally between those.

So we see that at the Reflexive special system level there is a difference that makes a difference produced between the distortions produced in associations and the discerned truth, reality, and identity of things that appear in the world beyond the phenomena. For though we live out among the things of the world and feel that we experience them directly when we look closer we become lost in a whole series of cunumdrums that the myriad philosophies prove are overwhelming. Science of course prefers to pretend ignorance of philosophical issues, and by ignoring philosophy becomes even more naively philosophical than it would be if it were a bit more savvy. But each of us every day are engaged in sorting out the Real world, the Truth, and the self identity of the things we encounter. We stake our lives on our judgments in these matters continually. This is why Berger and Luckmann talk

about the SOCIAL construction of reality, or truth or identity. We base our judgments not only on our own experience and intuitions but on the experience and judgments of others that we trust that we encounter in ongoing social situations. The ability to discern gestalt pattern formations in the underlying swarming substance of ourselves (if we follow the Magician SGS model) is a fundamentally social endeavor that is built into us from the foundations. That social nature that is primal, prior to the arising of any individual, is also intimately connected to the emergent. What is true, real and identical changes dramatically over time. We need to be in tune with those changes that are either superficial (called artificial emergence) or profound (called genuine emergence). Artificial emergence arises as we have said by the chance combination of features (genes) to form some component combination that has never been seen before. Genuine emergence arises when a new instance of a new kind of thing orthogonal to what already is possible and exists arises either from the inside (new meanings) or outside (new things not seen or heard of before). Notice that emergences appear on the inward and outward horizons of the ultra-efficiencies of our consciousness. The social is according to G.H. Mead the ability of our socialized species to create and respond to emergent eventities appearing inwardly or outwardly. We cannot do that alone! That takes the ultimate in subtle testing by the intersubjective cohort from all angles to see whether then new thing is genuinely new or not. Only a group of us working together can do that. And by that work we radically transform the world we all project together. We create new rewritten pasts that show how our history leads up to that emergent event and we project new futures based on the existence of the emergent entity. The final reflexive level that establishes the social actually takes us into an new horizon where there is endless manifestation of novelty. Changes are continually occurring at the level of facts, experiments, theories, paradigms (Kuhn), epistemes (Foucault), and interpretations of Being (Heidegger). Many of these are radical changes brought on via genuine emergence of the utterly new. It is this level of functionality that any real social simulation must capture to be authentic. It is this level that the formalism of the Emergent Meta-system attempts to lay bare for exploration.

The component system of Kampis can only capture the kind of novelty that occurs when we put together a set of components that had never been put together before. But this combination existed in the design landscape described by Kauffman's NK model. Because it did not actually get embodied did not mean that it did not exist as a possibility covered by the design landscape. Goertzel's SGS model goes further. Because it is based on Chaos theory and that theory mixes order and disorder in a

non-intuitive way we see that it covers a much greater territory when it comes to novelty. The pattern formation operator of the Magician SGS must not only recognize patterns in itself that it has seen before but also new ones that it has not seen before. When it looks at what seems to be disorder this may only be a pattern that it cannot recognize as such as yet due to the fact that it is trapped in a chaotic attractor that is larger than its computational ability. Component systems create open ended computational search problems. SGSs go further and actually produce problems that may be finite but will take longer than the universe has existed to compute. So there may be a new order that we cannot recognize because it is part of a very large attractor cycle or even a strange attractor that does not repeat itself but is endlessly self-similar. So both CS and SGS open up horizons to the new and SGS even goes so far that they might arise out of the finite or the infinitely self-similar. But neither of them guarantee being able to recognize these novelties. An Emergent Meta-System goes further. It sets as its goal to recognize new instances of new kinds of things that are genuinely emergent and appear orthogonally to what already is possible or exists. This is precisely what a social meta-system does. Therefore we must set ourself a goal that goes far beyond conventional artificial intelligent learning systems who generally attempt to relearn things after the fact and occasionally learn something new by some kind of theorem proving within a formal system. EMS must learn the unheard of, unexpected, considered impossible in order to replicate social learning. So in the EMS contrary to SGS we talk positively about the hardest problem, the recognition of or production of the emergent event. Of course, we scale that problem by stating that it only has to be emergent to the SGS magician system that is the receptor of the emergent event. So it does not have to be emergent to the human race at this point in their history. Magician systems recognize some novelty in themselves. Goertzel summarizes this with his equation creativity equals rules plus randomness where randomness might actually be an unrecognizable order. The EMS deals with the problem that unrecognizable orders must become recognizable to be embodied as emergent eventities. This recognition of the unrecognizable that sounds like another special system paradox is the crux of EMS. EMS confronts this daunting challenge by embodying the ultra-efficiencies we have discovered at all the levels of dissipative, autopoietic and reflexive special system formations. In other words, magician SGSs has a structure has a structure of a meta-algebra with three different operators. These are the annihilation, mutual action, and Pattern formation operators. Annihilation presumes mutual creation among the magician components as well out of the background social field. We attribute that creation operator that Goertzel does not mention that must be the complementary of the annihilation operator to the level of the algebra operating on

the real numbers alone. Real numbers appear as values in variables and out of that all systems and special systems and meta-systems are formed. The addition of a dissipative level that can act as a nowhere for the original real level that can order it brings with it the ability to annihilate the two by taking them out of conjunction. Then we added mutual action when we lost the commutative property and gestalt pattern formation and recognition when we lost the associative properties as our algebras weakened. Mutual action and gestalt pattern formation are clearly also dual operators. The magician SGS components act on one another to create patterns in themselves and then those patterns are recognized by them. The recognition of patterns in themselves is what assures that the social fabric is fundamental in magician systems. Entities can have mutual action without being socially connected in a fundamental way. But things that recognize mutually constructed patterns in themselves are engaging in a social action that is emergent. Magician SGSs therefore have operators associated with each ultra-efficient level and this structuring of their operators assure a global coherence to the Magician formal system that can recognize newness within the swarm in the guise of the unrecognizable. What EMS adds to this is a specific modeling of each layer based on the analogies between the special systems and the alternating division algebras. What we hope is that the ultra-efficiencies that are harnessed by this close modeling of the special systems will allow us to recognize the unrecognizable. Not recognize it as unrecognizable but recognize what it is in truth, in its reality, in its actual identity.

This means that for Emergent Meta-Systems the Kauffman landscapes must not just dynamically change as EMS components co-evolve with fitness landscapes projected from each to each. Rather the landscape maps of the design landscape of all possible EMS components must occasionally transform as completely new possibilities give rise to new individuals of orthogonally different kinds. This utter transformation of the landscape is not just the loss of convergence as we adjust the K parameter. It is the remapping in a completely different dimensional configuration that accounts for new kinds and unexpected and confounding things appearing out of no where without warning. In other words our maps must assume discontinuity and prove continuity instead of the other way around as Kauffmans maps do. One way to effect this kind of modeling from a simulation point of view is to realize that it could be that we do not just have one swarm but a whole series of swarms that are isolated and then suddenly commingle. In this way the magicians suddenly encounter the utterly new within their own frame of reference which is magician swarms. Goertzel has created a Simulation Ecology and Environment (SEE)

formalism that creates a network of ecologies for magician SGSs. If we imagine different swarms of magicians moving through these connected environments then we can think of them as being isolated for a while and then suddenly confronting another tribe of magicians SGSs that are of a totally different construction with their own history. These confrontations within the SEE could be one way to simulate emergent events. The node in the SEE where they meet then becomes the experimental chamber where we see how they react and change in the presence of a new kind of swarm that they must begin to co-evolve with.

Another point of extreme interest is the fact that Magicians SGSs can be seen to be composed of content that are themselves swarms of Magicians. So although the SEE gives us an external environment for magicians to inhabit it does not say anything about the internal construction of the Magicians themselves. We could model them at a single level of manifestation designing them specifically to function. But a more interesting possibility is to think how to create magicians out of magician swarms at some lower level of design. And it then becomes a matter of design how many such levels might exist and whether any of these levels can be re-entrant or whether there is a specific magician design at some level. What this possibility tells us is that although the external horizon is limited by the SEE there is no necessary limit to the internal horizon of the designed Magician SGS. This lack of articulated internal horizon can be seen to correspond to the fact that the Reflexive level borders on the endless arising of emergent eventities. There may be no limit to the internal virtual worlds of the Magician SGSs. Even though the external environment is set in some sense the internal mirroring of that external environment is free from constraint. Of course it is possible to create an external environment that can evolve and change using Evolving Algebra notation there is still not the same level of dynamism outwardly as we can conceive inwardly.

Another constraint we place on the simulation is the use of Cellular Games as the medium for the magicians in the swarm to relate to one another. Cellular games is an extension of the concept of the cellular automata. But cellular automata have rules that apply to all the cells in an array. We should not that cellular automata are perfect examples of dissipative structural systems. However, cellular games seek to apply Genetic Algorithms in order to discover rules that converge on certain fitness functions. Each cell creates its own rules and evolves that rule with succeeding generations as cells die and new cells are given new cells. Cellular Games solves the problem of the organization of nodes with the SEE and establishes the fundamental dissipative foundation out of which the higher levels of conjunction

are constructed within the EMS according to the application of the algebraic models. By referring to a game it establishes this dissipative field as fundamentally social as all games are social to some extent. And by using the Genetic Algorithm structure we get the fundamental dynamic of the swarm that will allow it to evolve naturally. The genetic algorithm will be modified to allow for the nomination and voting process of the Magician SGSs as well. But the operations of mutual action and gestalt pattern formation will be modeled on the cellular game structure. Therefore we see that our design of an prototype Artificial Intersubjectivity simulation is pre-constrained by the SEE environment, the EMS augmentation of SGSs, the definition of EMSs via the Evolving Algebras notation extended toward quantum computability, and the fundamental dissipative structure will be taken from Cellular Games. In this way we attempt to use other formalisms as tools that constrain but advance out design of artificial socialization.

We note that the dissipative structural system within the cellular game motif gives us cells that appear as our embodiments of desiring machines. These desiring machines are the lower level strata out of which individuals are expected to rise spontaneously as emergent global properties. Then these individuals are expected to produce the social relations as a further level of social construction of truth, reality and identity which has the goal of recognizing or producing emergent eventities. However, since the desiring machine level is embedded in the primal social fabric from the beginning the social is not just produced as relations between individuals but are embedded in individuals from the beginning. When we consider a component soup, we should not just consider the chunks floating around but also the medium in which they float. In this case the soups medium is the social fabric and the chunks are desiring machines that give rise spontaneously to individuals that have social relations while moving through the lifecycle of the swarm and co-evolving. These swarms move through the SEE and occasionally or often as the case may be interact changing one swarms design landscape radically without necessarily randomizing it. This swarm is asked to recognize that change and realign itself internally to cope with it perhaps giving rise to new eventities in the process that it can recognize as new patterns in itself that correspond to vital changes that arise internally or externally. Many levels of swarms within magicians allow our simulation to create robust internal virtual worlds to model its situation. The depth of the hierarchy of magician SGSs within magicians is unbounded whereas the static or dynamic SEE is practically bounded and corresponds to the external virtual world of the EMS.

Beyond the last alternating division algebra there are further levels of non-division algebras. The next level is representative of all the others and is called the Sedenion (more properly the sedecimnion or 16nion). When we move to this level we lose a cluster of minor properties the most important of is the ability to divide which implies a loss of linearity. Our major interpretation of the algebras that connect and give intertransformability between variables is as timestreams through which the dynamical systems unfold. Each timestream can be considered to be an autonomous agent in spacetime, or together then can be seen to make up a composite agent that can intertransform between timestreams to maintain quasi continuity. But when we reach the Sedenion level these time stream can no longer be seen as infinite lines but instead must be seen as circles because multiplication of two positive numbers can give us zero as a result. This in effect isolates the fifteen octonions that appear within the Sedenion. The Sedenion contains multiple independent worlds. We can use this fact to create multiple worlds within our EMS simulation. These worlds though are not all equal and in fact it is highly possible that three of the worlds are ultra-efficient bearing as worlds the same kind of relation to each other that the quaternions have with their strange holoidal interpenetration. This insight came from the analysis of the Minimal Design Methods that I have written about on former occasions. It turned out that when I applied the theory of Holonomic and Ultra-efficient systems to the field of possible design methods I found that there were exactly four dissipative minimal methods out of the sixteen possible ones. These four dissipative special systems combined to create six virtual autopoietic systems special and then fifteen virtual reflexive special systems. Of these fifteen three were different from all the rest. These three managed some how to bridge the fundamental constraining of all the combinations of minimal methods. That fundamental constraint is the impossibility of making certain combinations of methods so that the whole design is invisible from any one of the four major viewpoints on any real time systems design. But at the reflexive level this fundamental gap was miraculously bridged in three of the reflexive special systems leading to the discovery of an ultra-efficiency at the reflexive level to complement those examples of solitons and superconductivity analogous to the lower levels. This surprising development leads me to speculate that there is a similar differentiation of worlds at the Sedenion level. This would mean that there are not only ultra-efficient characteristics of aspects within worlds but whole worlds themselves are ultra-efficient. We can understand this by thinking about the phenomenal of Flow that occurs psychologically. In flow we temporally enter into a different world where time stops and things we do exactly occupy us and take us to our limits but not beyond. We posit that there is a social counterpart to flow. That social

counterpart is the chiasm between the collective unconscious first shown us by Jung and social consciousness that amounts to mutual resonance and joint trances like those described by George Leonard in the SILENT PULSE. The chiasmic fusion of social consciousness and social unconsciousness is Social Flow. Where individual flow has time stand still social flow is dynamic resonance and trance that brings us into touch with the archetypes in the collective unconscious. We hypothesize that in the ultra-efficient worlds we enter into social flow and thus live within the quaternion structure rather than viewing it from the outside.

The quaternion structure is a very interesting one that is the very model of interpenetration. It is a holonomic structure in which each part is simultaneously the whole containing all the other parts and a part being contained. The containment is reminiscent of Hypersets or Non-well-founded sets defined first by Aczel. But in the quaternionic structure there are only three such elements and the sets are never directly members of themselves. Instead they are only members of themselves thorough the mediation of one of the other elements of the quaternionic system. We can see that the quaternionic system is such that the three elements together produce the singularity. But in pairs they produce each other. Since commutative property is lost if you reverse the order of the pairs they produce the opposite of the other. And since each one is both whole and part at the same time following perfectly the dictates of Koestler's Holons, each one produces the others who in turn produce the first one and its opposite in an endless self-referring braid. At the quaternion level what we have is a mirror structure that reflects everything in the universe. At the octonions level seven different quaternions appear that reflect each other and this is the top of an endless set of layers defined by Pascal's triangle. The top three layers of this infinite pyramid are different in that they define the alternating division algebras. As we proceed from these layers using the Cayley-Dickson process to create new non-division non-associative non-commutative non-linear algebras we get a picture of Indra's net of the interpenetration of the universe where every jewel in the net reflects all the other jewels. This is the highest vision of the interpenetration of emptiness produced by the Mahayana Hua Yen Buddhists. When we move to the Sedenion level though there is a surprise. Although, there is no more linearity or division property of this algebra as a whole there is still the differentiation of the three ultra-efficient octonions from the other twelve. If were to enter into the social flow that produced these ultra-efficient worlds we would find ourselves within the holonic and holoidal structure that we see from the outside in the quaternion. The quaternion is impregnable only reflecting the other autopoietic nodes in Indra's net. But suddenly an emergent event might occur and

flip us into the social flow that define these three ultra-efficient worlds that are three aspects of the same one actually one. A higher goal of the EMS simulation might be to emulate social and psychological flow and the advent of the ultra-efficient worlds. If we look at the book The Invisible Landscape by the MacKennas we see in that some indications of what this world might be like. They predict social and psychological catastrophes in which our consciousness as a historical intersubjective totality are suddenly raised. The entry into ultra-efficient worlds would have a similar effect. We see this on a small scale with the prevalent social form of the cult and their end of the world scenarios that some times lead to mass suicide. The idea of mass suicide leads us to now consider the effects of meta-systems on our definition of the EMS. Unlike the SGS the EMS is a meta-system not a system. So it is necessary to understand what this transformation might mean. The Sedenion structure represents the meta-system structure. It along with all the other layers of Pascal's triangle embody that structure that together form Indra's interpenetrating net.

The primary feature of the Meta-system is complementarity. We understand this in terms set forth by Arkady Plotnitsky in his books Complementarity, In The Shadow Of Hegel and Reconfigurations. In these books Plotnitsky explores the connections between the work of Bohr, Derrida, Godel and Bataille. He shows that each of these theorist's work point in a very similar direction even though they had very different starting points. Of special interest is the work of Bataille who in The Accursed Share makes the distinction between a restricted and a global economy. A restricted economy in our terms is a system gestalt and a global economy in our terms is a meta-system proto-gestalt. A global economy has essentially no boundaries to the circulation of information and energy. Whereas artificial limits are imposed on the systems restricted economy in order to make sense of it in isolation from the rest of the worlds energy and information economy. Essentially the news of the meta-system is that this artificial separation cannot be supported and maintained and always breaks down. Every restricted system economy is haunted by its meta-systemic shadow which have been explored by Godel and following him Derrida. Undecidability is one of the major aspects that haunt all closed formal systems that arise through the suppression of the global economy. And undecidability is between complementary opposite formulations that arise between systems views of some phenomena. So we may say that every system has a shadow complementary anti-system that is repressed in any particular systemic formulation. The difference between Euclidean and non-euclidean geometry is an example. The anti-system hovers in the background and appears when the system's axioms of closure are

questioned. Then we suddenly find that the system and anti-system are complementary antinomies that if formulated separately and simultaneously cancel each other out as Kant suggested. So we are forced to make a decision between the system and the anti-system but no real basis for such a decision exists. As we oscillate between the two we find that one highlights some aspects of the phenomena we are describing while the other highlights other aspects and the tradeoff in the highlights is what makes the two complementary. As Bohr says about Quantum complementarity these two exclusive formulations is all we have as a means of looking at the phenomena that is being modeled. There is no deeper theory that will unify the two because complementarity is intrinsic to the meta-system.

Undecidability of the meta-system is only one of its complementary aspects. Looking at it from another point of view we could see indistinguishably or indeterminateness in the same light. So we see that the meta-system is where the truth, reality, and identity of the system breaks down and shades off into the milieu of the global economy that the system cannot ultimately be separated from. Ultimately we cannot draw the boundary of the system and distinguish it from the gestalt background on which it is a figure. Ultimately we cannot tell if the system is complete because we cannot enumerate all of its elements decisively. Finally ultimately we cannot decide between complementary alternative formulations of the system. What we see is that the opposite of the consistency, completeness and soundness of the system that we formulate is the inconsistency, incompleteness and unsoundness of the global meta-system. That meta-system is always already lost as the origin of the system. That meta-system is the indefinable arena of the interaction of systems and anti-systems where myriads of unexpected effects arise to effect that interaction. Notice here that the relation of the system and the anti-system and their cancellation reminds us of the Magician and anti-Magicians of the SGS. However, Goertzel has only thought the Magician SGS in terms of a system not in terms of a meta-system. So the question becomes how do we make the magician SGS into a meta-system?

The meta-system spontaneously gives rise to systems and anti-systems that either annihilate (in physus) or cancel (in logos). But we can go on to note that meta-systems also spontaneously produce increasing or decreasing positive feedbacks. These are called either miracles or black-holes in common parlance. So that the meta-system is always a dangerous landscape for either the system or the anti-system to inhabit. These unaccountable increasing or decreasing returns are exactly

what systems theory is designed to avoid. And they are avoided by the use of negative feedback loops. In essence the autopoietic system is an attempt to find a balance in the unbalanced landscape of the global economy by using a hypercycle of negative feedbacks. But all that has to happen is for that hypercycle to lose one member and become odd (?) for a positive feedback that either increases or decreases out of control to be created from a balancing hypercycle. If the control cycle is not fixed then the autopoietic system would break apart and be destroyed by too much positive feedback. In the global economy there is no conservation. In other words energy is created out of nothing and destroyed taking it back into nothing in ways that are incomprehensible. This is why we attempt to stick to systems and avoid the meta-systemic shadows that haunt all our constructions. However, what Bataille noticed is that Societies make use of meta-systemic effects and turn them into positive social value. This ability to create transcendentals out of pure gifts or deprivations by society shows that all social fields must be meta-systemic. That is why emergence is identified with the social by G.H. Mead. An emergence is a pure gift and is balanced by Holocausts that are pure incomprehensible destructions for no reason. Either one can be a source of meaning in the global economy. What we notice here is that our concept of ultra-efficiency must be balanced by the concept of ultra-inefficiency and that these ideas actually arise as complementarities out of the general economy spontaneously. So the EMS must be a meta-system not a system.

I have studied what it takes to turn the Magician SGS into a meta-system and this occurs by changing a single assumption about them. That assumption is that the swarm lives on after the voting. You see that although the revolutionary lifecycle of the swarm is discontinuous there is still a continuity of spacetime underlying their formulation. What we need to do is break this continuity of spacetime and suddenly we have a meta-system. This is similar to the loss of linearity as we move from the Octonion to the Sedenion level of algebra. There are no longer infinitely long linear timestreams but the timestreams suddenly move in circles. We move from linear time quite naturally to circular time that rules the great bulk of Indra's net defined by the Pascal triangle of non-division algebras beneath the cap stone of the three division algebras. That cap stone is like short term memory to long term memory within our psychological functioning. The space within which linearity exists as an illusory continuity is very restricted and limited in comparison to the whole of Indra's net. The cap stone allows us to relate different timestreams worldlines within spacetime. But what we find is that as we relate more and more of them our algebras weaken. We can only really completely intertransform between two

timestreams. And it might be for this reason that superstring theory works as a basis for physics. Superstring theory posits that one dimensional strings not dimensionless particles should be the basis of our physics. These one dimensional strings create worldsheets that connect the two worldlines defined by their ends. These worldsheets reflect the connection within the complexnion algebra of the real and imaginary numbers held in conjunction. If we take these worldsheets and connect their ends creating loops then this is equivalent to gravitons which cannot be distinguished from spacetime itself. We have just formed worldsheets that envelop a region of spacetime. These are equivalent to autopoietic systems. On the loop moving through spacetime we lose the property of directionality but gain a topological orientation where deformations in the circular worldsheet define its properties. Interacting circular worldsheets would give us a system equivalent to the reflexive system we have lost another property but gain an understanding of long range fields within spacetime. These superstring theories highlight the importance to physical theory of the alternating division algebras. This can be seen in the work of Frank (Tony) Smith and X. Dixon who use the octonion as a basic component of their physical models. And as Onar Aam has suggested this shows that the physical laws with their forces and particles as they exist in supersymmetries that fall out of superstring theory are themselves ultra-efficient in some sense. If we quantize our universe as Hawking as recently proposed we do rather than particles what we see are all the possible universes arising out of the probability density function of our universe. Ours and the dual shadow universe that arises in string theory is most probable because this is the one in which there is an ultra-efficient resonance of the fundamental laws and constants of physical theory. It is not just that consciousness is ultra-efficient but on the other hand the laws of the universe that we live in are also ultra-efficient in the sense that because they form a resonant synergy they have out lasted all the others that are not ultra-efficient which have merely become fluctuations that quickly fade away within the probability wave function of the universe that gives a picture of all possible other universes. To say it another way, because one particular synergetic combination of forces and particles that are based on the symmetries of $SO(32)$ or $E_8 \times E_8$ is ultra-efficient all other combinations cannot persist as long so this becomes the natural basis for a universe that produces intelligent life (dissipative autopoietic reflexive special systems) which are also ultra-efficient who can look out at that universe and attempt to discover its laws. Physicists always marvel that mathematics can be used to describe nature so exactly even in its inexactness as with quantum mechanics. This is because behind the dualistic split between logos and physis is a single unique nomos that is the basis of the ultra-efficiencies of both sides of the dualism. Existence itself is the chiasmic

non-dual reversibility between these two obstinately different views of the kosmos. One is centered on us but cannot get rid of the external world and the other is centered on the external world but cannot get rid of our participation in it. The chiasmic world that gives rise to these two complementary systems for viewing the kosmos is inherently meta-systemic and the ultra-efficiencies arise spontaneously out of the meta-systemic field. They are balanced by the ultra-inefficiencies of blackholes in the universe and of nothingness that Sartre finds at the heart of consciousness.

If we assume that spacetime itself is discontinuous such that at the end of the lifecycle of a swarm all the current members died and then those that survived the nomination and voting were resurrected to flourish in the next lifecycle duration then the magician SGS would suddenly become a Self-Generating Meta-System (SGMS). This would also bring what might seem to amount to insuperable problems that are so radical as to be impossible to overcome. Problems such as where do the spores of the next generation get deposited, how do they become revived, what happens to spacetime that is discontinuous? All very serious problems that perhaps we do not want to face. The theory of Emergent Meta-systems face these problems and others like them directly and explicitly. Goertzel's Magician SGSs can be interpreted as meta-systems but we must realize that this is really a radical extension of his ideas, so it is better to realize what we are dealing with here is essentially a different animal and begin to deal with under the rubric of the EMS. Once we add the radical discontinuity of the spacetime substrata to the discontinuity of the swarm itself with its separate lifecycles then the question of whether SGSs accept radical emergence becomes moot. Suddenly we are dealing with a completely different situation where there is radical and deep discontinuity we are assuming is primary over any kind of continuity. And it is very difficult to see how we might get ourselves out of this theoretical corner gracefully.

When we look back into the intellectual history of the planet we see that there are really very few people to ever suggest such a bold hypothesis. However, it is not without some precedent. To point of fact there is one group that held exactly this position and they were the Mahayana Buddhists, the very people who posited that emptiness IS interpenetration and formulated the image of Indra's net of jewels that all reflected each other. Their view of Karmic action contained this very paradox of complete cessation and continuity. Their image for the resolution of this paradox was the Tathagata Gharba (The Womb of Thusness Coming). For them all of manifestation was autopoietically closed into a womb. But that womb had a dynamic driven by Karma. Yet they did not believe in any self that the karmic deposits might

be attached to so there was a basic paradox between the illusion of Karmic causation of phenomena within the womb of thusness that comes through Karmic action and the reality of the illusion of the self to which those karmic deposits are attached. Basically they posited that there was what is called the Alaya-vijnana or Storehouse Consciousness. The Storehouse Consciousness was at the root of manifestation and it is where the seeds of karmic causation were planted by desires that later bloomed into phenomena. So they embraced the paradox of radical discontinuity by positing a different kind of place wherein the seeds were placed that was essentially outside or deep within the tathagata gharbha.

Our answer to the problem of radical discontinuity is very similar. We are going to posit something beyond spacetime which we will follow the formalism of Evolving Algebra to call the Reserve. The Reserve is the place equivalent to the Storehouse Consciousness where the seeds are laid down that later bloom to give rise to another generation of an EMS swarm. In other writings I have jokingly referred to this as the Akkashic Record, where mystics say all the knowledge that ever existed is stored and can be accessed in a manner suggestive of Plato's recollection. However, we will go further and develop the concept of the Reserve into an important aspect of our theory of EMSs. Let us begin by positing that there are actually three Reserves one associated with each of the dimensions related to Truth, Reality and Identity. These together form a three dimensional space with positive or negative direction out of which each thing brought into existence comes. Purely negative things have little truth, reality or identity. Purely positive things drawn from the reserve have less falsehood, illusion, or difference. Or something drawn from the reserve might have a mixture of positive and negative features on these dimensional scales. Things when they are created are drawn from the Reserves and when they are destroyed (annihilated or canceled) they return to the reserves. Thus the process of manifestation continually circulates things out into manifestation (tathagata gharba) from the reserves (alaya-vijnana) and back out again. But also because the Reserves are a potential phasespace it can also be invested with the seeds of the winning EMS components that survived the vote so that they can fructify in the next instant. Or we could look at it a different way and say that EMS components that win the vote are instantatons that pop in and out of the Reserves as they circulate in and out of spacetime. This gets across the idea that they are a potential trough outside spacetime through which things may circulate and remain continuous even though spacetime is itself discontinuous. Now we have not just shifted the problem of continuity back a level because we can immediately say that this quasi-potential trough through which EMS instantatons might travel or seeds may be laid down

both does and does not exist at the same time. In other words from one point of view it exists and from another point of view it does not exist. To the extent it exists we are supporting continuity and to the extent it does not exist we are supporting radical discontinuity. Our viewpoint is that it does AND does not exist. So you can see that what we have done is forced the complementarity of the meta-system on the problem of continuity and discontinuity. This is probably the most sophisticated intellectual position that can be obtained vis a vis the problem of continuity and discontinuity. It is essentially supra-rational having the nature of what the Zen Buddhists call a Koan.

We will also introduce another formalism here in order to understand the nature of the relation between manifestation and hiding (or the noumena). What we need is a logic of showing and hiding along each of the dimensions we have described. This is given to us by August Stern's MATRIX LOGIC. Matrix Logic combines logic and mathematical matrix operations to produce a single system that is far stronger than ordinary logic. One of its features is that it uses vector truth values. These vectors can take the bra or ket forms and be transformed by truth table matrices. Within the matrices in the ordinary formulation due to Stearn it is possible to have three truth values in the two places of the vector -- 00 indicates neither true or false; 10 indicates true not false; 01 indicates false not true; and 11 indicates both true and false. So the matrix logic allows both neither...nor and both...and partial truths. But matrix logic goes beyond that to allow a negative truth value that can be interpreted as hidden. This generates another five kinds of partial truth which has to do with whether the truth is partially hidden to completely hidden. We will go beyond that and add one further form of truth value which is imaginary that has to do with self-reference. This adds another eleven partial truth values to give sixteen partial truth values in all. This is based on an application of Greimas Square to the completion of the truth values extending Stern's original system. Once we have identified each of these truth values and applied them to the truth dimension of the reserve it is realized immediately that we need to apply it to the reality and identity dimensions as well. This gives us an immediate bonus of showing how we can manipulate the movement of things in and out of the reserve using Matrix Logic operations. But it also shows us that at the center of every object there is a quaternion of imaginary values from each of these dimensions. That quaternion of values is how each thing enters into Indra's net. In the reserve each thing is merely a jewel in Indra's net. It is a perfect holoidal and holonic form to the extent it is referencing itself only. When something is manifested then that pure jewel is eclipsed by being hidden or rendered positive or negative along the dimension of

either truth, reality or identity.

Now we have a complete theory of the manifestation of things. Something may be manifest as an appearance along any of the dimensions or it may be hidden as a noumena or it may become more completely hidden in the reserve. To the extent it is only self-referring it can be within the reserve. To that extent we can say based on Godel's diagonalization process that it is impossible to prove that it is or is not within the system of manifestation. Thus we get by a fluke of our formal logic's limitations that the existence AND non-existence of the Reserve and its contents is perfectly possible. The intermediate position of the Reserve is similar to the position of hidden variable models in Quantum Mechanics. As such the EMS as meta-systemic element is a contingent possibility which we can actually use to produce results within the world. By making the EMS a meta-system we can unite the global structure of the SGSs with its operators and the specific structures of each of the division algebras into a single formalism that is actually opposite General Systems Theory in every way. We have constructed a General Meta-Systems Theory of which EMS is the embodiment. It is not just that every system has an anti-system but also every system has its meta-systemic shadow and this can be realized as a dynamic embodiment through the articulation of EMSs.

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Emergent Meta-Systems have the following features:

They are quantum computable.

They are extensions of the Component Systems and Self-Generating Systems of Kampis and Goertzel that are also quantum computable.

They account for genuine emergent events.

They are meta-systems not systems.

They embody radical discontinuity through the positing of Reserves that both exist and do not exist.

They contain partial systems and anti-systems within the meta-systemic field.

The partial systems and anti-systems either cancel or annihilate or both.

The partial systems and anti-systems are created by a creation operator out of the meta-systemic field.

The partial systems and anti-systems embody desiring machines.

The partial systems and anti-systems as desiring machines combine to create systemic individuals (restricted economies) that have emergent global

properties greater than the sum of their parts.
The individuals have explicit social relations in an implicit social field.
The EMS has global operators taken from SGSs for annihilation, mutual action and pattern formation.
The EMS has specific articulations following the pattern of the alternating division algebras applying conjunction to produce dissipative, autopoietic and reflexive systems.
They are described by Evolving Algebras.
They exist a swarm as a field of Cellular Games.
The field of Cellular Games exist within the Simulation of Environment and Ecology (SEE).
Internally each magician is composed of swarms of magicians to an arbitrary depth.
The spacetime of the nodes in the SEE have an adjunct of three reserves related to truth, reality and identity respectively.
Things are brought out of or taken back into the reserve through the use of Matrix Logic operators along each of the dimensions of the Reserve extended by a further self-reference truth value that augments each dimension generated using the Greimas Square.
The reserves both exist and do not exist and embody the "no where" out of which order spontaneously arises for free.
Each swarm of EMS components coevolve with each other and all other swarms in their SEE nodes.
Emergences are simulated by populations from two isolated nodes encountering each other.
Virtual SEEs may be simulated in the indefinite layers of meta-magicians and virtual magicians within those virtual nodes may meet each other for the first time in order to simulate emergences that occur internally rather than externally.

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Emergent Meta-Systems are an extension of the concept of Self-Generating Systems developed by Goertzel in Chaotic Logic. SGSs are a dual to General Systems Theory of George Klir. We take that dual and clarify and push it further. It is an important discovery that General Systems Theory has a dual which points to the existence of a General Meta-Systems Theory. Where systems defined by GST are turing computable Component Systems of Kampis, Self-Generating Systems of Goertzel and Emergent Meta-Systems are not. Instead these further types of

Systems or Meta-systems are quantum computable. We show how EMS completely embody the special systems which are the intermediary representations between systems and meta-systems and thus well suited to be the basis for the transformation between them. Where SGS can also be seen as SGMS, EMS embodies radical discontinuity of spacetime while specifically embodying the structure of the division alternating algebras instead of only the global operators in the meta-algebra of SGS.

It is important to develop this theory of General Meta-systems Theory (GMST) as a dual to GST as it completes the picture that has so long been only partial of how systems interact with their meta-systemic shadows and how ultimately systems interact with each other. Such a theory is by its very nature complex and supports the interaction of a large number of different formalisms to constrain any simulation of Artificial Intersubjectivity that might be developed based on the general theory. This is because the project is similar to the construction of a higher dimensional physical theory. There are so many ways to construct the likenesses of Meta-Systems that without constraining the problem it would be impossible to decide what form the simulation that embodied the theory should take. Much of the art is combining the right sub-formalisms into an aesthetically pleasing combination which generally shows how such a meta-systemic view can be supported and even simulated. The concept is to develop a simulation with a social field built in from the first as primal and out of which everything else arises as emergent properties. This social field takes a radical view of what is sociality (the response to and creation of emergence) and pushes the assumption of underlying discontinuity to the limit. It allows us to claim to have developed an autopoietic sociology that marries the concerns of social phenomenology with the concerns of computational sociology. An autopoietic sociology builds models of social situations based on the analogies with the alternating division algebras and brings out the ultra-efficient qualities upon which such Reflexive special systems are based. Of course the ultimate social ultra-efficiency is Love. It is the existence of Love that gives our individual existences the most meaning. We won't go so far as to claim that our Emergent Meta-Systems swarms are "lov ins" but we will say that they exemplify radical sociologically based thinking about the nature of autonomous computational agents that do not form systems but instead form meta-systems which have as their by product the emergent global properties of systems within the simulation.

[End of Working Paper as of 951115]

2. Non-Duality

The backdrop for this study is a very fundamental change in the way we look at existence. That change has to do with the shift from looking at the world exclusively through a dualistic lens and instead showing the importance of sometimes looking at existence through a different lens of non-duality. One of the primary dualities that the Western Philosophical and Scientific tradition uses to split existence is the very old and fundamental distinction between *logos* (mind) and *physis* (body). The world is assumed to be pre-split along these lines. A dualism reduces one side of the split to nothing while inflating the other side of the split into everything. So for instance, we get the difference between materialism and idealism which champions one side of the split over the other, in fact to the exclusion of the other. This manifests itself in the split between academia and industry and within academia between the sciences and the humanities and so on to create an extremely intricate pattern of bifurcations between disciplines and subjects that are upheld by traditions of scholarship.

There are very few non-dualistic theories about the world that have been proposed and none have gained any wide-spread favor within our tradition. However, strange as it may seem there are other traditions that are primarily non-dual in their approach to the world such as the Traditional Chinese and the Traditional Islamic Philosophical and Scientific Traditions. Many of these "Oriental" nondualistic traditions have become very popular outside of academia and industry in the netherworld of popular intellectual culture. In fact, we face what might be called a crisis that the bulwarks of our own tradition have not come to terms with this other way of looking at things and for the most part do not admit that these alternatives exist. There is a great dissatisfaction with traditional Western models which is finding little satisfaction within the intellectual trends of the current academic and industrial climate. Yet subtly the change of allegiance of many people who have been effected by alternatives is having its effects. And so slowly there are those who are finding ways to bring non-dualistic modes of thinking, acting, and perceiving into contact with the traditional dualistic modes that are mostly power and control oriented. A good example of this is David Loy's study Nonduality which relates the basic theme of non-duality within East Asian religions and philosophies to traditional western philosophical sources. And we see several attempts to construct non-dual philosophies or systems theories within different branches of the humanities. An excellent example is John S. Hans' The Play Of The World which reformulates the non-dualism of Deleuze and Guattari in Anti-oedipus

into a more palatable form with less nihilistic overtones.

We are interested in Autopoietic theory developed by Maturana and Varela which we believe is also a theory that bridges this same gap yet in a different way within the context of the biological sciences. Varela himself has appealed to an Oriental religion in a recent book called The Embodied Mind where he explains how that theory is in sync with the kinds of ideas that are developed in Autopoietic Theory. We believe that Acupuncture theory is a better example of a theory that embodies non-dualistic premises than the Buddhist wheel of dependent co-arising called Samsara. However, both Buddhist and traditional Chinese non-dual theories were developed in China over the course of at least a thousand years and these different approaches to non-dualistic thought, perception and action are all important for us to study. Therefore in this essay I will begin with an example that I will provide some commentary on taken from the Buddhist Hwa Yen tradition of Mahayana Buddhism. We mentioned interpenetration in our preliminary sketch. Francis Cook in The Jeweled Net Of Indra and C.C. Chang in The Buddhist Teaching Of Totality both give ample background for this highly developed Mahayana Buddhist School that flourished in China. For our part we will concentrate on the ten principles of non-obstruction. These are traditional within the Hwa Yen school. We take our text from The Buddhist Teaching Of Totality page 208-223 where Chang translates "On The Meditation of Dharmadhatu by Master Tu Shun." This contains the following statements of principle:

II. Mediation on the Non-Obstruction of Li (noumena) against Shih (phenomena).

"Ten principles are set forth here to elucidate both the fusion and dissolving of Li and Shi, their co-existence and extinction, cooperation and conflict."

1. The principle that Li [must] embrace Shih.
2. The principle that Shih [must] embrace Li.
3. The production of Shih must rely on Li.
4. Through Shih the Li is illustrated.
5. Through Li the Shih is annulled.
6. The Shih can hide the Li.
7. The true Li is the Shih itself.
8. Things and events [shih fa] themselves are Li.
9. The true Li is not Shih.
10. Things and events [shih fa] are not Li.

These ten principles follow a discussion on the interpenetrating relation between Form and Voidness. These principles repeat this argument again with respect to the Thatagata Gharba's non-obstructing functioning. "Ten principles are set forth here to unite Shih and Li into one [inseparable whole]. Just as a large furnace can melt all metals and transform them into shapes of various images, Li can also dissolve all Shihs. The harmonious fusion of Li and Shih brings into the open a double non-duality. All ten principles are set forth here are meant to elucidate this principle of Non-obstruction..."

We will relate this to the Western Tradition in the following way. We tend to create dualisms and then claim the primacy of the principle of Excluded Middle set forth by Aristotle to keep those dualisms from collapsing into each other. However, it was Merleau-Ponty in his ontology that discovered that underneath our dualisms are a fundamental reversibility that makes them possible. That reversibility he called the Chiasm. It is of some interest that the words Chiasm which means a point of interchange that appears before separation (like the chiasm of the optic nerve) and the word Chasm seem to have opposite meanings. The principle of Excluded Middle establishes a Chasm between the dualistic pair that is unbridgeable and that is used by the dominate one to keep the other under control. But once we recognize the fact that within the Chasm beneath that maintained dichotomy the two duals merge into each other and display a chiasmic reversibility not unlike that we find in Relativity theory between the views of different observers. In fact, a good analogy is the Mobius strip which is locally dual but globally one-sided and one edged. In fact we might mention that the Penrose triangle that is the impossible figure used by Escher in many of his prints is the dual of the mobius strip. The Penrose triangle is locally intelligible but globally paradoxical. And to these two figures we can again say that they are both examples of extreme positions of paradoxicality that we cite because they are so aberrant in their nature, and that the truth must lie somewhere between those extremes. So when we attempt to find that truth and reject the chasm created by the principle of Excluded Middle that outlaws non-dual solutions then in fact we need to understand ten principles in order make sense of this region of non-dual reversibility. You will notice that as we progress the terms Shih (eventities) and Li keep reversing. Each principle is true from its own point of view. They are only apparently in conflict with each other and in fact if we can see past the possibility of conflict we get a glimpse of the realm of non-obstruction that defines interpenetration.

We will identify Li with what the Greeks call NOMOS which is the inner order that

appears shrouded within the Logos and the Physis. We are surprised when mathematics can be used to build precise models of physical phenomena. But this is because within the Logos where mathematics is developed and within the Physis where our physical theories get their inspiration there is a single *nomos* common to both. Dualism subverts and obscures this single *nomos*. This *Nomos* is called in Chinese Philosophy and Science the *Li*. It is the hidden order behind the way things unfold in the Logos and the Physis. It is both an explicit order and an implicit order to things that appears within things and on their surface. But the non-dual *Li* is more than we might expect because it goes beyond the ordering of the Essence of the thing that is associated with its Kindness. Instead it is of thinking of *Nomos* as only ordering things up to the point that the Kindness of the thing is determined and after that everything else is random, the *Li* determines everything very specifically in the individual as well as in the kind. So each individual has its own *Li* specific to it that makes every aspect of the individual exactly what it turns out to be. The Chinese have a different kind of opposition that they use to look at things in nature. That opposition is not dualistic but distinguishes between *Li* and *Chi*. *Chi* is the energy of things but not just gross energy, it includes subtle individual specific energies as well. *Li* does not dominate *Chi* nor vice versa. But these are two different ways of looking at the same thing. So in Acupuncture we would hear talk of *Chi* as the energy behind the eventities. We need to be able to switch between thinking about the order to the mobilization of the eventities that are ordered. Once the *Chi* flows then what is left over is the patternings like the grain in the wood of a single specific tree that has its own *Li*. But behind the scenes is an invisible *Li* that causes the *Chi* to flow the way it does in this tree and in all trees similarly but different in each. Thus *Li* is implicit order as a principle behind the scenes (*noumena*) and an explicit order. Similarly *Chi* is a subtle energy that invisibly flows around things and a visible gross energy of the kind that is conserved and that appears in Western physics. In this text the opposite of *Li*, i.e. *Chi*, does not appear but we can think of it as either an alternative for the *Li* as a basic principle OR as being bound within the *Shih* eventity.

1. The principle that Li [must] embrace Shih.

When the *Li* embraces the *Shih* we get the explicit ordering of the *Shih* by the *Li*. Explicit ordering is what we see everywhere around us in the ordering of the Logos and the Physis. It is the visible order of the world in all its aspects. *Li* (order) appears everywhere in spite of the so called tyranny of entropy. In fact there is a superabundance of Order that makes us doubt the veracity of the Second Law of

Thermodynamics. However, what we find is that if we separate out some system from the world that it will run down like a mechanical clock. Thus the superabundance of Order has something to do with the fact that the whole environment has reached some sort of supercritical state like that described by Kauffman in *AT HOME IN THE UNIVERSE* where he describes how we get order for free that spontaneously appears out of no where. This appearance of order that perhaps creates auto-catalytic systems and then eventually autopoietic systems appears unmotivated from no obvious place to reach a supercritical order creating regime so that any system that is not isolated may exhibit all sorts of order inducing and neg-entropic behaviors. We learn from this that Meta-systems are always spontaneously ordering and systems unplugged from meta-systems run down like wound up toys. The source of the Li as apparent and explicit ordering comes from the supercriticality of the Meta-systems.

2. The principle that Shih [must] embrace Li.

When the Shih embraces the Li we get the implicit ordering of the Shih by the Li. This is the opposite of the Li embracing the Shih. Here the principle of reversibility has made us take the opposite stance from that just explored. When the Shih embraces the Li the subtle aspects of the implicate order become revealed. The Li does not force itself on the Shih. Rather it is a marriage where the lover and the beloved exchange places continually. Thus the Shih can order itself according to the deeper order of the Li much better than the Li can manifest that deeper order. There must be an inner willingness of the Shih to follow the contours laid down by the Li in order for the deeper implicit order to be seen.

We take our understanding of implicate order from David Bohm who coined that term. The implicate order is the hidden order behind the obvious order. The order that cannot be seen directly as when complementarity stop us from seeing exactly what is happening in the quantum sphere. Or when we are prevented from seeing simultaneous events in Relativity. Or when we are prevented from knowing both the initial conditions completely and the entire phase space of the system under investigation as in Ilya Prigogine's formulation of the Second Law of Thermodynamics as a complementarity. All these complementarities arise in the meta-system that is the shadow of the system and anti-system duals. That complementarity was explained best by Bohr with his anti-epistemology which said we will never know what is beyond these complementarities, all we have is the complementarities themselves and what is beyond is hidden from us absolutely. We

complement the anti-epistemology of Bohr with an anti-ontology which says that there is no Being but only the Void identified by the Taoists or the Emptiness identified by the Buddhists such as Master Tu Shun.

The Meta-system's complementarities are the entry to the void. But this does not mean that there is nothing hidden behind the complementarities. What is hidden is the implicit order of the Li. Thus there is a hidden implicate order but no hidden variables. So although Bohem's model was wrong, in as much as it posited an epistemology beyond the complementarity, his insight was correct. There is an implicate order that emerges from the void through the subtle clinging of the Shih to the Li which is the opposite of the clinging of the Li to the Shih. The Shih can manifest this implicate order by following the Li beyond the Li's instructions to reveal the deep inner core of the Li that the Li cannot reveal by itself.

And this is exactly what this essay will attempt to get at. Because we can model explicit orders but we have great difficulty modeling implicit orders. We can easily see gestalts but we have great difficulties seeing the Proto-gestalts that order the gestalts. But we know they exist because we see the gestalts change discontinuously over time. We know these changes where something radically new appears are the manifestation of the implicate order beyond the explicit order of the gestalt. Implicate orders appear as discontinuities where as explicit orders appear as continuous patterns. Reading the lines of discontinuity between the gestalts is a far more subtle art. And we study that art when we give up on causality and accept that the Shih follows the Li of its own accord rather than being fully ordered. We lose that subtle nuance when we impose dualisms on the world and only recognize power and control rather than the subtle feelings that arise in marriage where there is a mutual arising and a mutual following that shows us the true origin of the autopoietic reflexive formations within creation.

3. The production of Shih must rely on Li.

The eventities themselves cannot arise without the Li. The Li governs their genetic development. Li is not a static patterning principle but instead has an inner dynamism. We see this in the temporal gestalt. Gestalts are not just spatial and visual but also temporal and auditory. And the auditory gestalts are interpenetrating sounds as Statler says in LOVE AND EXISTENCE. The auditory is the better model of the Social whereas the visual models and gestalts tend to isolate us as individuals through the imposition of perspective within our culture. So the gestalt

we are discussing is a temporal gestalt, not just a Being but also a Becoming. Prigogine makes the point that becoming through intrinsic reversibility is the realm of thermodynamics while dynamics with its reversible laws and lack of temporality is the realm of Being. In modern metaphysics it is realized that there is not two different things Being and Becoming: ontos and physis are roots that go back into the Indo-European heritage that gives the original differentiation of being into persistence and development. Instead there is a single Conceptual Being that is fragmented into different kinds. Two of these kinds are Pure Presence Being and Process Being. This means that actually no matter how we try to separate them by developing different sciences that Dynamics and Thermodynamics are two views of the same underlying structure projected onto the void of existence. The two are not separate but instead only two sub-kinds from the same ultimate category that is higher than any other concept and is projected on everything that there IS. Process Being as Prigogine notes gives rise to internal consciousness and the process which exhibit irreversible development, as in genetic development. Pure Presence exists only at the NOW and is the what exists at the infinitesimal moment of the Present. It is what is purely and completely available as Present Now. A temporal gestalt takes into account the passage of from the future to the past and also out of no where into the present and back out again. The temporal gestalts projects what William James called the Specious Present which is a temporal duration. G.H. Mead says that this duration is the amount of time it takes for something to be what it is. Henri Bergson called this private time of the system "duree" and Husserl identified it with internal time consciousness in his phenomenology. Now we know through cronobiology that such internal time exists in different animals which sees time running past in different internal speeds that are not necessarily fully tied to the objective speed of events as seen by an external ideal observer. The inability of observers to detect simultaneity is in some sense our inability to see inside each other's internal time consciousnesses. We must rely on external signals. This does not mean that internal time does not exist as physicists would have it but means that our internal introspective worlds are hidden from each other closed to direct inspection, and that is because each organism is an autopoietic closed system and because the observers cannot be separated from what they are observing. Shih relies on Li means that eventities have their own internal time by which they harmonize with implicit ordering of the Li. This is the opposite of the production of the external times by the Li. It is the Shih that produces the subtle manifestation of the implicate order by following the internal times given by irreversible processes that are set up by the Li.

4. Through Shih the Li is illustrated.

The shih are examples, analogies, and collages that exemplify the Li. The Li as pure order does not appear anywhere. Only things that are ordered appear. When we look at these patterns we are looking at the external ordering of the Shih by the Li. Internal times of the individual Shih are hidden and we only see the outward patterning. Each illustration is a gestalt. We perceive this gestalt and though it understand the order. Order is not just seen in the noema but also in the noesis. There is an ordering to actions that create the patterning of things. Thus in each of our ultra-efficient horizons of consciousness we perceive some aspect of the underlying order or nomos of everything. This is why we need to chose non-dual words that are both verbs and nouns to describe ordering. Patterns are Patterned. Forms are Formed. Shapes are shaped. These words that are both nouns and verbs show us the realm of things in which the thing acted upon is the same as the action acting upon it. Autopoietic systems inhabit this realm. Autopoietic systems are former and formed at the same time. They are patterner and patterned at the same time. They are shapers and shaped at the same time. This is the meaning of self-production which creates organization within a structural configuration by self-imposing an order. When we say take responsibility for ourselves we are saying become autopoietic in organizing our own actions, shape your self, and we take this as one aspect of maturity. For although we are naturally autopoietic as a form our behavior is not necessarily autopoietic. This taking on of the Li and illustrating it is how the Shih realizes itself.

5. Through Li the Shih is annulled.

The Shih is like a servant. The servant is eclipsed by the master. But this is not the outward eclipse of the Shih by the Li that dualism would create. Instead this is willing servitude. The Shih by following the Li completely, both inwardly and outwardly illustrates the Li so well that when we look at it we only really see the Li in every aspect of the Shih. This willing servitude is based on the fact that the Li does not overstep its bounds. It orders but then leaves the full implementation of its orders to its servants so that the servants love their master. This is well illustrated in the Tao Te Ching and the ideal of non-action. The great ruler rules by doing nothing and so the citizens do everything they should and think that it was all their idea. No action of the Li is how the Shih come to be totally obliterated in the ordering of the Li. Because after taking on the outer order and then voluntarily taking on the inner order there is nothing else, and the shih are completely effaced in the Li but without being dominated and destroyed because it is as if the Li did nothing.

Similarly the structural components of the autopoietic system become annulled in the organization of that system. They need to be there but each is replaceable and their structure is taken up and becomes subservient to the emergent order of the autopoietic system itself. So we see the organization and the structures are actually dispensable. Build right into Varela and Maturana's concept of the difference between structure and organization within the autopoietic system is the concept of the annulment or effacement of the Shih by the Li.

6. The Shih can hide the Li.

The Shih when it is fully effaced in the Li actually looks as it is in control and so hides the Li. In the autopoietic system this hiding is the closure of the system. The closure is what prevents us from direct inspection of internal time. The structures of the system are so organized that the Li is brought to the surface everywhere but we really only see the Shih. We do not actually see Li, Li is buried within the system and hidden from view in the very act of manifesting the Li fully. Why is this? Because there is an implicit and explicit pattern. We see the explicit pattern in the actions of the autopoietic system but we do not see what is going on inside even though in those inside actions the system is fully following the Li. So although the system is fully manifesting the Li in its internal and external actions we only see the external action so the implicit part of the Li is hidden. All we see are eventities and the actual order appears nowhere even though it's results appear everywhere.

7. The true Li is the Shih itself.

When the Shih fully manifests both the intrinsic order and the extrinsic order then there is no difference between the Shih and Li. So in reality the Li is the Shih and the Shih is the Li. This ultimate reversibility between them is the substance of the next two principles. There is a level on which the Real Li is the Shih, in other words the hidden is manifest everywhere and is merely the appearances. This is a very interesting statement because it means that things in the world are ultimately transparent. There is always some way to see inside everything even the autopoietic system is transparent from a certain perspective. It is transparent in that it is wholly embodying the Li, so that what we see is exactly what we get. The autopoietic system is itself a manifestation. The fact that it can exist means that the whole of the Li can be seen in it as an illustration of the Li itself. Thus when systems become autopoietic their structural organization is the truth of the Li made manifest for all to see. The autopoietic system's structural organization is the reality of the Li. There

is nothing to the Li beyond intrinsic and extrinsic ordering. When that ordering is manifest both in intersubjective time and internal time then there is nothing else to show of the Li and we have seen the true Li in the Shih.

8. Things and events [shih fa] themselves are Li.

Now we reverse again following the play of the chiasm and we state the opposite of the last principle which is that the true shih are the Li only. In other words the Shih have no existence or value other than embodying the Li. The true Shih is only in the Li. This is brought out by the statement of <??> in KNOWLEDGE PAINFULLY ACQUIRED that the fundamental rule of existence is the following: One Li; Myriad manifestations in variety. The whole purpose of the Li is the out pouring of variety. The Li is the means by which this outpouring occurs in existence. All the variety not just of kinds but of articulations of individual states of affairs in individuals are a manifestation of the Li. So the Li unifies everything THROUGH the myriad manifestations that flow from its source. But the only purpose of that source is to make the myriad things come into existence. There is nothing beyond that in the Li. So when we look at the myriad things unfolding and infolding out of and into the void then we know the Li completely. There is also nothing to the things other than the Li. So once we have seen the myriad things in all their variety then we have known the Li completely by knowing the things completely in all their copious splendor and cornucopia of variety.

9. The true Li is not Shih.

But then we return to the statement that although in one sense the Li is the Shih and vice versa. There is still another sense in which they are separate and distinguishable. Because not everything taken separately is autopoietic. Because we cannot see all the variety at once or in its full panoply. We are finite observers of a bounty beyond our kenning. So we see the eventities and search for the Li that underlies the overflowing bounty that issues from the void. Notice that the Li is not beyond the void. It is in the ordering of all things that comes from the void. It is hidden within the things just as they are. Not as a deception but by the very fact that they flower and we perceive that flowering and only later do we consider the order that appeared in that unfolding.

10. Things and events [shih fa] are not Li.

Similarly we must reverse our stance and say that the Eventities are no more the Li than the Li was the eventities. We know that the things ordered are not the order themselves because it is clear that the order is spontaneous and comes out of nowhere. It is unexpected and definitely against the rules if one of those rules is the second law of thermodynamics formulated as an absolute. When systems run down that is only because they are artificially unplugged from the global economy of the Meta-system. The meta-system and its complementarity is the doorway to the void which we see clearly when we affirm anti-epistemology and anti-ontology. When a system is plugged into the meta-system then there is unending order appearing from nowhere. But if we artificially create an artificially restricted economy then in isolation this system runs down as the source of order is suppressed. When we create that artificial restricted economy we see a gestalt we have isolated from the background of all the possible gestalts. We have turned somethings into background and other things into figures and that suppresses all the things that could vie to be part of the foreground. In the meta-system there is no selection possible. It is what Deleuze and Guattari call a rhizome, all middle and no beginning or ends, all networks and no trees. We create trees by picking up a particular node and making it the figure so that it becomes the root of a tree in the network. Any node could be that. The things and events (eventities) in the networks are not the same as the explicit and implicit orderings of that network. The trees are the explicit orderings. But the network itself as parts floating in the field of the meta-system, as a rhizome, has an implicate order that only shows up in the manifestation of all its discontinuities. The network is a montage, collage, mosaic, swarm that has an inner ordering not seen in the things and their relationships but seen better in its articulation as a fourfold.

A fourfold if we take Spencer-Brown's LAWS OF FORM as a departure is made up of the aspects of the FORM that enter into his Laws. The laws are a Nomos of Form. But behind the Nomos is the Li that differentiates the four aspects: Something, Nothing, Levels and Multiplicity. These are used to define the laws:

Multilicity = something

Leveling = nothing

The opposite of these are the superficial laws of Pattern rejected by Spencer-Brown

Multiplicity = nothing

Leveling = something

These two sets of Laws are the complete ordering. Spencer-Brown selected one and rejected the other setting up a dualism. The dualistic version he selected modeled transcendence. The version he rejected models immanent pattern rather than form. Form and pattern form a chiasm and together define the dissipative system. Spencer-Brown selected the part of the dissipative system that is disordering the environment and expanding impressing its order on that of the environment. He rejected the formulation which shows that patterns come in from nowhere through the singularity to order the dissipative system from within. But either of these sets of laws are just part of the story. The whole story is identified with the Li than makes Pattern and Form a chiasm and gives rise through them to the Dissipative special system.

The swarm, mosaic, constellation, network, or what ever we call the parts of the meta-system strung out in the field in the shadow of the deconstructed system and anti-system we must agree that those nodes are somethings and they exist in slots of layering and multiplicity. The positive aspect of this are the hierarchies where layering dominates and in the network where multiplicity dominates. But also we know that there are layerings of nothing and multiplicities of nothing that form as meta-levels above the swarm. These layerings and multiplicities correspond to ramified logical types as defined by I. Copi in Logical Type Theory that is derived from Russell's theory of Meta-levels. Each of these meta-slots hovers in layers over the swarm as the way that it avoids paradox. When they collapse into the swarm then you have a Hyperlist which is an extension of Aczel's Non-well-founded Sets. But the point is that the swarm is full of slots either made out of something or nothing and it is filled with things or no-things. This definition of the swarm itself within the fourfold is more basic than the relations between the things or the actions of the things that come to be considered more readily than the fourfold that defines the swarm.

In our development we want to define the things in the swarm as Emergent Meta-System components. We identify the fourfold in which they are embedded with the Alternating Division Algebras and then we give them the operations of the Magician SGS meta-algebra. Thus each of the elements trapped in the fourfold can create, annihilate, mutually act, and produce as well as recognize gestalt pattern formations. And also the swarm itself can do these operations on the elements of the swarm. One direction we get individual action and the other direction we get collective action. Every thing or EMS component is itself a swarm, which in turn have component swarms to an indefinite depth of nesting. But we can cut off this

manifestation by placing the swarm in an environment within a network. In other words as soon as we define the swarm thorough relations between nodes then we have set a limit to the expansion of the Hyperlist. For convenience we do this by embedding the swarm in the SEE defined by Goertzel.

But within the swarm we consider that because it is a social milieu that the EMS components will play games with each other. We follow Hans in his definition of play as the basic activity that explores a non-human plasticity in a given environment. So by this we achieve non-duality because we assume that all things can play and that it is a universal action complex that can be articulated into games. So the sociality we are defining is not just a human sociality but an intrinsic sociality that can be seen in all things. This is similar to the definition of desiring machines given by Deleuze and Guattari in which human functions are not distinguished from non-human functions. Anything that works can be considered as a desiring machine and these working parts can be glued together like the elements of Kampis's component system. We have moved up a level and said that because sociality is intrinsic and because play is a universal action complex by which eventities explore possibilities then we will define games that will define different games each level of our virtual machine. The virtual machine itself will be considered as an algebra in which each eventity has certain operations. Relations will be considered as signatures of functions. So relations will only exist as messages that are sent between agents in the swarm and there will be no reifying relations between things but only various directed mappings where the mappings can continually change. We will use the Evolving Algebra notation of Yuri Gurevitch as our way of treating the somethings of the swarm. This will allow the operations to be changed at will as the swarm develops over time. New things can be brought in from the Reserves and the actual functions can be changed on the fly to give our swarm the ability to evolve.

Because the swarm lives in a fourfold it is already intrinsically a model of interpenetration. Fourfolds segments mirror each other. The terminology of the fourfold is due to the Late Heidegger who identified the segments with Heaven, Earth, Immortals and Mortals. Within the fourfold that unfolds and splinters according to the Cayley-Dickson process earlier incarnations of the fourfold unfold to create later incarnations as the fourfold fragments. The mirroring is build into the structure of the Cayley-Dickson unfolding. That unfolding displays a conjunction of mirroring elements. When that fourfold reaches the Sedenion (16nion) level then the algebraic structure is a pure network and linearity breaks down so we see the

network as an infinite mirroring of quaternions and a model of interpenetration.

Our case it that this structure is non-dual intrinsically and so exemplifies all the principles explained above relating the Li and the Shih. It does this because it is the very model of an dissipative autopoietic reflexive special system. No other formation can come so close to non-duality because no other structure embodies interpenetration in the upper reaches of its architecture in the same way. As the system fragments it runs right into interpenetration which is what occurs when you put hyperlists into a network. In fact that is the meaning of the loss of the Alternating Division properties of the hypercomplex algebras. The system can no longer make divisions within itself stick and so it merges into one thing. It is divided by losing non-linearity and illusory continuity vanishes as time become circular. This circularity of time and the impossibility of making divisions within itself allows the network to interpenetrate and become Holoidal. The loss of division destroys the illusory continuity which allows part of the network to hold aloof from the rest. The figure collapses into the ground and the whole thing merely continues to differentiate into the indefinite depths of long term memory as the short term memory of the meta-system that allows it to create systems within it are lost. Short term memory means restriction. The meta-system can no longer create restricted economies except as local fluctuations so the mirroring of the hyperlists takes over as the fundamental motif.

1. The principle that Li [must] embrace Shih.
2. The principle that Shih [must] embrace Li.
3. The production of Shih must rely on Li.
4. Through Shih the Li is illustrated.
5. Through Li the Shih is annulled.
6. The Shih can hide the Li.
7. The true Li is the Shih itself.
8. Things and events [shih fa] themselves are Li.
9. The true Li is not Shih.
10. Things and events [shih fa] are not Li.

When we look at these principles again we see that they embody non-duality. First they explicitly embody reversibility as each pair reverse each other. As we work through the reversals we encounter deeper and deeper layers of meaning in the relations between Shih and Li. Second the revering principles can be see as representing phases on either side of the reversibility at the center of the chiasmic

interval between the possible dualistic positions that would occur if we seized onto one principle and raised it above the others. The principles form a swarm or mosaic that continuously encounter each other from different angles to shed light on each other continually. Yet still there is a definite chasm between the two principles of each pair that give us an antimony.

We notice that the pairs of opposite principles stand next to each other in conjunction. And with this we realize that the principles themselves may somehow be expressing the form of the fourfold. In the alternating division algebras it is conjunction that allows them to achieve perfect balance which places them exactly between the surplus of systems and the lack of meta-systems. It is the conjunction of numbers that allows them to produce perfectly balanced forms which also have a critical broken symmetry. Symmetry and balance are themselves in some meta-balance in the Alternating Division Algebras. So let us look closer at the metonymy of the principles and see if we can understand this linguistic model of the fourfold. Certainly the reversal of the principles implies that they mirror each other. But here we have five mirrors. Those mirrors express mutual-embracing, mutual-elucidation, mutual-effacement, and then two that are related which is mutual-identity, and mutual-difference. If we appeal to Heidegger's concept of the Same as belonging together which is neither absolutely identical nor absolutely different, then we can perhaps see the last two principles as expressing mutual-Sameness. This then gives us four mirrors:

Mutual-sameness

In other words Shih and Li are both identical in reality and different in unreality. They are neither completely identical nor completely different. We can say with Heidegger that they belong together in their duality and complementarity. We see this in all the complementary opposites that arise from the meta-system. The system and anti-system are always opposite each other as duals in every respect. But many times as in the case with Euclidean and non-euclidean geometry the two duals when studied together produce a greater whole and we realize that they are two facets of some deeper thing, in this example a deeper viewpoint on the nature of geometry. What ever issues from the void as complementary opposites has this aspect deep duality that renders the system and the anti-system a necessary relation of mutual-dependence.

But when we talk of system and anti-system it is different from Li and Shih

because both the system and anti-system are Shih. The Li is the inner and outer ordering that produces the complementarity. But even this relation between order and ordered has a similar belonging together that becomes apparent in the relations between the antimonies.

Mutual-embracing

After the system and the anti-system arise as complementary duals then we see that they mutually embrace each other. This mutual embrace allows each to be what it is through the other. It is like a marriage of male and female which are complementary duals in the same way. Each has its strengths and weaknesses made up for by the other and through conjunction they operate in a way that neither could alone.

When we talk of Shih and Li we see that this mutual embracing takes a different form between the order and the ordered. It takes the form of extrinsic and intrinsic ordering. The extrinsic order comes from the Li embracing the Shih. This is the ordering of kindness. But the intrinsic ordering that comes from the embrace of the Li by the Shih that is more subtle and deeper can only be seen in their reverse mirroring. The system and the anti-system indicate and voluntarily follow the deeper ordering that is intrinsic. This dynamic indicating is like a compass that continually points to the intrinsic ordering of the Li. Because the gestalt experiences emergent events this pointing must continually change in order to continue pointing toward the Same. This distinction between the two embracings is like Nietzsche's concept of the difference between will to power and eternal return of the same. Extrinsic order is like the will to power and intrinsic order is like eternal return of the same.

Mutual-elucidation

If we have only the system or the anti-system we have incomplete knowledge. Likewise if we only have the dual systems and not the meta-systemic field of partial systems that make up the system and anti-system then again we only have incomplete knowledge. Complete knowledge can only occur when we can move back and forth between the system and anti-system comparing them. And likewise that we can move back and forth between the duals and the meta-systemic shadow they cast over the landscape. The different mappings of that landscape is a crucial piece of foundational epistemic knowledge that grounds our understanding of the dual systems. This is because when we change the mapping of the meta-systemic

landscape we intrinsically change the relation between the system and the anti-system. Bateson talks about this effect in *MIND AND NATURE*. He says that the information we get by studying two different subjects at the same time is always better than what we would get if we studied them separately. This is why specialization is such a handicap imposed on students in our academic system. Specialization cuts out the ultra-efficiency that occurs when we conjunct subjects under study. Systems and Anti-systems are examples where this increase of information efficiency occurs, and it is boosted again when we combine the study of these with the opposite meta-system. There are dual meta-systems in a domain and dual domains in a world, do this effect scales up as we rise upon the emergent ontological hierarchy.

When we talk about Li and Shih instead of just the shih of systems and anti-systems or meta-systems then we are discussing the mutual elucidation of the Order and the Eventities. We see the order within the eventities and we see the eventities in the order. Since they are opposites not duals they completely exhaust each other so that there is no shih beyond the manifestation of the myriad varieties so when we see the myriad varieties produced by the Li we have seen all the Li and similarly when we have seen both the intrinsic and extrinsic Order we have seen all the possibilities of the Shih. When we look into the varieties we see the production of the shih and we see in those varieties the illustration of the Li. Notice that just like in the belonging together in Sameness there is a slight difference between how this relation manifests from each side. This slight difference produces a little distortion that is the key to the understanding of the fourfold. There is a little interference between the two reversible perspectives and this renders them slightly different and spoils their absolute identity. Shih do not produce the Li and Li do not illustrate the Shih. There is instead a transforming distortion within the reversibility that makes it so that each brings out the best in the other. This is similar to Heidegger's concept of Earth. The work of art is between Heaven and Earth. It needs to stand in the light of the heavens so it can be seen but it subsists of polished earth whose natural qualities are brought out for everyone to see clearly. This bringing out of the specific qualities of the materials in the work of art gives something that can shine in the clearing of Being and it brings out the best in the possibilities that the Earth of the materials have to offer. Thus there is this mutual elucidation where each brings out the best in the other.

Mutual-effacing

But the mutual elucidation is balanced by mutual effacement. In the case of systems and anti-systems they either annihilate (physis) or cancel (logos) each other. So they cannot really be seen together at the same time except as ideas. Either we take one axiom or the opposite axiom. They are mutually exclusive so that we do not get mixtures of Euclidean and non-euclidean geometries unless we create some special construct like Riemann geometry. Similarly if we are looking at the system as a whole greater than the sum of the parts then the lacks of the meta-system do not appear. Whereas if we concentrate on the lacks as deconstructionism does then the surpluses do not appear. So we see that from a practical standpoint the antinomies are exclusive of each other and the relation between the antinomies and the landscape they appear within are also mutually exclusive as well unless we deliberately create a hybrid.

Switching to the Li and Shih we notice that Order and Eventities are also mutually effacing. But again there is a distortion between these as the Shih are annulled and the Li is hidden. So the Shih vanish when we look at the Li whereas the Li merely is hidden behind the Shih. We see this above where we saw that the different aspects of the Shih seen as system, anti-system and meta-system vanish due to mutual exclusion. The mutual exclusion is the annulment of the Shih. It is the Li that imposes this mutual exclusion as a condition of existence. Similarly when we are concentrating on one of the expressions of the Shih then we do not see the mutual exclusion and that is hidden by the very fact we are concentrating on one aspect and not moving between aspects. So the difference between annulment and hiding is a distortion that keeps these two reversible principles from being identical yet through them we see the great similarity in the actions of both of them. We can think of the ordinary situation where art does not prevail and we lose our aesthetic sense. Following the argument of Heidegger in "The Origin of the Work of Art." When art does not prevail then the Earth of the materials are never shined and the spot in the clearing of Being is never prepared. So in ordinary relations to objects we see a dual effacement. There is an annulment of the Earth aspect of the thing because they are not brought out to be seen, and there is a hiding of the Heaven aspect because there is no focus on a specific aesthetic thing. So the Li of Heaven is hidden and the Shih of Earth are annulled where we take annulment to be as if they have never been, utterly lost. The qualities of the things are utterly lost if we do not polish them. The qualities of the space in which the things are highlighted is hidden because it is taken over for other purposes.

Now we have noticed that mutual-sameness and mutual-embracing are opposite

effects and mutual-elucidation and mutual-effacing are mutual effects. These belong together with each other. We can call the first two the establishing of distinctions and the second two the mirroring. And we note again that these two establishments belong together and mirror each other. They are in fact one and that oneness is a very deep unique single source of everything that manifests and that is hidden. Ultimately there is one fourfold but it unfolds by a series of bifurcations. The first bifurcation establishes the difference between distinctions and mirroring. The second bifurcation establishes the mutuality of sameness, embracing, elucidation, and effacing. The third bifurcation establishes the principles which are a broken symmetry because four principles provide the mutualness of sameness and two principles each provide the reversibility of each of the other three mutualnesses. So when we look at unfolding of the principles we see that there is a cascade:

Figure 216:

oneness	1
establishment	2
mutuality	4
principles	$(2+2+2)+4$
identity and difference	$2+2+2+(2+2)$

It is of interest that String theory would give us a universe that contains ten dimensions which are split into the four of spacetime and six compactified dimensions. There is a final step of the unfolding of identity and difference out of Sameness. We might guess that this could be seen as reality and unreality from some other perspective or truth and untruth from some other equally valid perspective.

Now when we look at this cascade we can see that it is similar to that of the division algebras. We can think of it as a series of conjunctions and infoldings of our ten principles. The initial distinction of establishment might be like the distinction between imaginary and real numbers. Then these might divide again by the provision of a second mirroring into the quaternion algebra which then would unfold into the algebra of the octonions through a third mirroring. At the level of the second mirroring mutuality appears and in the quaternion that exists in term of the Hyperlist structure based on mediated Non-Well-Founded Sets. In the third level of mirroring the reversibilities that embody these mutualities appear and manifest the distortions we found in some of those mutualities. Also at this point there is also the broken symmetry of the further break out of identity and difference from sameness. At the level of the octonion there is a double mirroring that is added instead of a

single mirroring because the octonion is equal to an inwardly mirrored tetrahedron. Similarly at the quaternion level there is also a double mirroring because the quaternion is the same as three mirrors facing each other instead of two mirrors. This doubling comes from the fact that a mirroring intersects a mirroring at each state. The first mirroring that establishes is crossed by the second mirror that gives mutuality. The crossing of mirrors causes the crossed mirror to bifurcate, a similar thing happens when the third level of mirroring is added onto the top of the crossed mirror. It causes the added mirror to bifurcate. So the Fourfold ends up being a progressive bisection. But at each level there is a broken symmetry. Between the reals and the imaginaries there is a broken symmetry that favors the reals. In quantum experiments the non-locality of the imaginaries vanishes to yield real values. Similarly at the octonion level there are the three imaginaries of the Hyperlist that are set off from the reals as the single imaginary breaks apart into a threefold structure. This Hyperlist structure is holoidal and holonic. It is the mirror within which interpenetration is seen as it gives us a mirrored ball whose parts are wholes. But this holonic inwardness is still balanced against the real but the emphasis has shifted to favor the imaginary over the real. Then with the next unfolding we see the full panoply of reversibilities that inhabit the Greimas square unfold. At the octonion level there is an internal anti-greimas square within the field that holds the seven quaternions. Asymmetries and symmetries abound and interfere with each other. We find intertwining mobius strips in the representations of the octonion. All the reversibilities with the inherent distortions and identity within difference and difference in identity give us a complex and dynamic interference pattern that takes on many shapes from different angles.

I believe that we can also see the final splitting of Sameness into the four principles of identity and difference is a hint of the further splitting of the octonion by the Cayley-Dickson process into the Sedenion level. There are fifteen octonions at this level and we lose the Alternating and Division property at this point. This means that the timestreams become bifurcated for the first time instead of just splitting from each other. Circular time appears. And strangely enough by losing the division property the network of the swarm ceases to be able to divide itself against itself and so it becomes interpenetrating and self-mirroring only from this point forward in the Cayley-Dickson unfolding process. Interpenetration is the result. And interpenetration is precisely about the Sameness and belonging together of all things. The splitting of sameness into identity and difference marks the transition into interpenetration. Also at the Sedenion level the three ultra-efficient worlds that cohere like the quaternion only instead we are inside them instead of locked out of

them. So it is at this point that we can live inside a world with social flow that is interpenetrating and we can contrast this world with the twelve other worlds that are all flawed in some way and less efficient. So at the sedenion level there is the possibility to entering into a holoidal structure that embodies interpenetration completely and that is seen in contrast with the other flawed worlds. In this we can see the difference between enlightenment that knows about the interpenetration of the network and the ignorance that lives within interpenetration without experiencing it. So the sedenion level is important from the point of view of the experiential realization of the meaning of interpenetration as opposed to the ignorance of it which is central to the Buddhist teaching. The mathematical structures that appear in the Alternating Division algebras support the Buddhist position that we are all enlightened but just do not realize it due to the illusions we have. The infinitely deep Pascal's triangle is made up of quaternions that all reflect each other and interpenetrate with each other as they unfold through the Cayley-Dickson process that generates the progressively bifurcating fourfold. But at the cap stone of the triangle we have the illusion of continuity rather than circular time. And in that illusion grows up the holoidal form of the Hyperlist quaternion structure. But we are outside it. when that turns into an octonion then we experience the play of reflection around the closed space of the cap stone. Here we reach a limit in which the reflections rebound around a trapped space creating interfering illusions. At the next stage a tetrahedron of imaginaries are created that link the worlds that are separated from each other as three of them are irrevocably joined into a quaternion structure. If you are within that quaternion structure of interpenetrating world then that would be the same as experiencing enlightenment and knowing the interpenetration by embodying it. But if you are withing the twelve segmented worlds then you would not know the reality of interpenetration even though you lived within it. It is amazing that the Alternating Division algebras have such a fine and subtle structure that parallels the insights of Buddhism so clearly. And although the structure of the principles are not an exact fit to the mathematical structure the fit is close enough that the major points of correspondence at least give us pause to reflect on the subtlety of the Buddhist heuristic. What we see is that the mathematical model and the logico-linguistic models complement and help us interpret each other. In fact we can say that they belong together as mutually elucidating each other. When we are within the mathematical the linguistic is hidden from us and when we are in the linguistic the mathematical is hidden from us. What we hope to do is to realize the mutual embrace of the logico-linguistic and mathematical in order to fully

understand the inner coherence of these two different models of interpenetration and the production of illusion that creates our world. Hopefully in that the relation between Shih and Li will shine through and the way they inform these models will become clear.

Now we return to look at how these principles lead us to look at the dissipative autopoietic reflexive special systems.

1. The principle that Li [must] embrace Shih.
2. The principle that Shih [must] embrace Li.

At the dissipative level the Shih is what is being patterned and the Li is the order that flows into the system from no where.

At the autopoietic level the Shih is the Structure and the Li is seen in the organization that is self-imposed.

At the reflexive level the Shih is the way the dissipative systems are organized into virtual autopoietic and virtual reflexive systems. The Li is seen through the distortions as the non-nihilistic distinctions that are seen through and inspite of the distortions.

At each level the Shih is extrinsically ordered by the Li but there is also the subtle ordering in which the Li continues to order the Shih by the Shih following the Li beyond the extrinsic ordering to also display the implicate ordering.

At the dissipative level the implicate order is in the feedback that occurs between the disordering of the environment and the appearance of order from the singularity. This subtle feed back loop is gives the dissipative system it's peculiar form of non-locality. It is like the crystallization of a Penrose tiling. There has to be some non-local or global knowledge of the entire dissipative system that builds up such a tiling in an actual crystal because the connections between fitted together components cannot be direct but alternated like in the mediated inclusiveness of the Hyperlist. This non-locality and quasi-globality is achieved in the dissipative system though a feedback between the disordering of the environment and the ordering of the system from nowhere through the singularity. The order and disorder must be complementary duals of each other. This complementarity can set up a system/anti-system type resonance so that the disorder controls the order and

the order controls the disorder.

At the autopoietic level the implicate order is in the fact that a given pair of dissipative systems makes up an autopoietic system and another pair makes up another autopoietic system. These form a symbiotic relationship. But each of the autopoietic systems can trade off dissipative systems with the other so that there are actually six virtual autopoietic systems given four dissipative systems. This mutual exchange between dissipative systems that give rise to multiple autopoietic virtual systems is the implicate order behind the explicit order in which specific dissipative systems are conjuncted in the embodied autopoietic pair. This means that the Li organization of the Shih structures is complemented by other possible Li organizations of the Shih structures. Those complementary possibilities form the background or implicit order upon which the explicit manifest order is erected.

At the reflexive level the implicate order is seen in the further expanding of the virtual background reflexive systems beyond the one that is embodied. This virtual background creates an order related to the sedenion. So the sedenion is implicitly present as the background of the reflexive system. The octonion produces distortions that create endless similitudes that from chaotic structures of Sameness. But these distortions make it possible to see the non-nihilistic distinctions that are enfolded into the emptiness as the implicit structures that are invisible but do not change within the changing world. So here the implicate order expands the range of virtual possible relations behind the embodied reflexive system and at the same time adds the rendering of invisible constraints visible through the play of distortions as the Chaotic sameness of endlessly differing and deferring similitudes are produced.

3. The production of Shih must rely on Li.
4. Through Shih the Li is illustrated.

At the dissipative level ordered dissipative structures are created and the disordered environmental structures are produced. Both of these as complementary opposites are based on the invisible ordering principle. These complementary opposites illustrate the Li as they come into existence out of no where to become a stable regime.

At the autopoietic level we see the autopoietic system producing nodes of the autopoietic network. Those nodes of the network are controlled by a hypercycle that

is in no where in relation to the catalyzed reactions.

At the reflexive level propensities or tendencies in a situation are produced that make up the social fabric. These propensities make it possible for the possibilities to make contact with the probabilities to produce actualities. The actualities are the illustration and the propensities embody the reliance. Without the propensities there could be not real connection between possibility and probabilities. Nothing would come into existence, less well emergences.

5. Through Li the Shih is annulled.

6. The Shih can hide the Li.

At the dissipative level we can see that the environmental ordering of shih is eliminated in favor of a new order that comes form the dissipative system. The fact that one order replaces the other hides the fact that there is an inner connection between the replaced and the replacing orders. This inner connection is the implicate order. The implicate order is hidden by the will to power of the dissipative systems expansion of domination by replacing one order with another. But we see the proto-gestalt appear again when we realize that there is a succession of replacements and we wonder about the internal coherence of the series of gestalts.

At the autopoietic level there is the domination of organization over structure on the one hand that annul the Shih of the structure. And there is the closure of the autopoietic system that hides the internal time and the following of the implicate order within the organism.

At the reflexive level there is the creation of the internal and external mirroring of the quaternionic system within the octononic system. This mirroring of the social and the psychological hides the internal principle that is the same behind both. We ether look at one or the other. It is either the Society of Mind we concentrate upon or it is the Social relations of autonomous individual organisms. But behind these duals there is a single Li that is hidden. The shih that are annulled are the patterns that are disturbed by imposed distortion that non-associativity brings. What is important at this level are the production of endless similitudes of Sameness in which the differences become blurred and lost between the individual elements within the World of the octonion. This endless chaotic mixing creates what Goertzel calls a multi-lobed strange attractor at the center of the octonion due to non-associativeness. All the components lose their own patterns in this process of

mixture.

7. The true Li is the Shih itself.
8. Things and events [shih fa] themselves are Li.

At the dissipative level the circulation of the orders through the inversion process back into the singularity and out to the environment gives us the identity between the Li and the Shih. The Escher waterfall based on the Penrose triangle in which separate coherent regions do not cohere globally but make possible a strange flow that feeds itself as a single self-feeding irreversible process. The flow and the ordering of that flow once achieved are the Same. That sameness flows from the fact that there is also the mobius strip formation that makes the Shih and Li which are locally different globally the same.

At the autopoietic level the system as self-producing embodies the paradoxicality of the uncertainty principle between initial conditions and the phase space of the entire system. As Prigogine says you cannot know both at the same time so you either know one or the other. Initial conditions and reversible rules cannot be known together in actuality. Thus the intersection between dynamics and thermodynamics are embodied by the autopoietic system that encompasses the paradoxicality of the uncertainty of entropy, the uncertainty of simultaneity, and the uncertainty of measurement. The uncertainty of entropy has to do with the fact that there is no global running down even though unplugged and isolated systems will run down. The universe is not a system but a meta-system. Understanding that would create a profound change in physics what is trying to build a universe as a system and keeps running into the pluriverse meta-system. The uncertainty of simultaneity brought out in Relativity Theory gives the autopoietic system its closed nature. We cannot look inside and directly inspect internal clocks. The uncertainty of measurement from quantum mechanics show up in the probability distribution of the autopoietic systems behavior. That wave collapses when we observe an actual behavior but nothing can give us the collapse before hand. All these uncertainty principles come together in the autopoietic system's paradoxical formulation. So in that way the Shih and the Li become one in the autopoietic anomalous special system. The Li is the certainty that is hidden from us and the Shih is the phenomena that we observe in our perpetual uncertainty. Since there is no depth to the autopoietic system due to the inherent anti-epistemology and anti-ontology what we see on the surface is the deep hidden truth. The truth is that you cannot know what is inside the autopoietic system. The truth is that what you see is

all you get.

At the reflexive level the invariants that appear through the distortions are the inner truth of everything that is visible. The visible invariants are the reality of the variations and the massive variety that pours out of the void. But on the other hand all the myriad things in all their splendor and magnificence are a full showing of all the order that there is. There is no hidden orders beyond the orders that inform all the visible things. At least this might as well be the case as we have no access to any orders beyond these anyway. So the reflexive system takes the paradoxicality of the autopoietic system and turns it inside out. It says that comes out of tall the autopoietic systems together is a full picture of the truth of the Li. So the environmental milieu as it exists is out way to see all that is inside the organisms. It is an external mirroring of what is within the closed organisms. So at the reflexive level it is as if the autopoietic closed system has been turned inside out. The behavior of the autopoietic systems taken separately is a probability wave that collapses randomly. But the web of relations that they produce together is anything but random. It is instead a finely tuned co-evolving structure in which all the possible behaviors are played out until we see all the possible combinations exhibited and pruned based on their fitness.

9. The true Li is not Shih.

10. Things and events [shih fa] are not Li.

Ultimately the whole gambit of reversibilities between Shih and Li allow us to differentiate them.

In the dissipative system the ordered regimes that appear at different temperatures or in the presence of different concentrations of catalysts will be different and will give us a view to a whole spectrum of possible orders that may occur in that dissipative structure. What is ordered by those regimes are inert chemicals that without the irreversible processes would seek their lowest energy and lose information. But as long as the local economy is plugged into the global economy the fission of kinds of work will continue and different economic periods of growth and decline will occur. Thus we can follow the picture give by Jane Jacobs in The Birth And Death Of Cities and see how it is the urban centers that generate the rural economies that are plugged into the commerce between cities that make up the global economy. Thus there is a difference between ordered contents and the boundary in the dissipative system and this is played off against the chiams of form

and pattern. The formal is the embodiment of the Li and the pattern is the embodiment of the Shih and these though fused are always different within the compass of their reversibility.

In the autopoietic system we see the difference between the organization and structure of the system over and over again played against the chiasm between cognitive and living functions. The cognitive is the embodiment of the Li and the living is the embodiment of the Shih. The autopoietic system uses negative feedback to weather the storm of the meta-system in which blackholes and miracles abound. The homeostasis build by the hypercycle of negative feedback loops is based on being able to recognize and maintain invariants within the system in relation to the environmental fluxes. Without the difference between the cognitive Li that recognizes the variances and the living processes that adjust to them there would be no possibility of self-production.

At the reflexive level there is the difference between distortions and invariants which gives an emphasis to the chiasm between the social and the psychological. But at this level it is undecidable which is the Shih and which is the Li between these two components that mirror each other. Instead we see the invariants that appear within the void as Li and the distortions in the organization of the autopoietic system as Shih. So at this level it seems that the difference between shih and Li is no longer chiasmic. This may be why the series comes to an end at this point. Suddenly we are oriented to what lies beyond the void and the emergent eventities that appear from out of the void. These appear in the psychological realm and are mirrored in the Social or they appear in the social and are mirrored in the psychological. But either way the emergences that appear give us a glimpse of another deeper proto-gestalt with implicate order that drives the series of emergences that we must create or respond to. That ordering of emergences appears to be the highest manifestation of Li and all the emergent eventities are the highest manifestation of Shih. In other words the difference between the Shih and the Li are inscribed in what the social and psychological mutual mirrorings see and react to. If they did not have the emergences then everything would vanish and be unable to manifest for the same reason that we cannot see something artificially held stationary before the eye. Without erratic change nothing can be visible and it is the emergences that drive erratic change. They are the random orthogonal fluctuations that changes the map and give us new territory to explore. Suddenly the Li is not within the system itself any more. But the system is turned inside out and has become ecstatic projecting a world that is ever changing and renewing itself. That

which renews is the Li and that which is renewed is the Shih. The internal coherence of the renewals is the Li and the eventities that bring the Novum of the renewal itself is the Shih.

Shih and Li emanate from the void and return to the void.

Ultimately there is only the void and the deep unity that lies beyond the void that is neither Shih or Li. That deep unity is the single source of all causation.

[End of working paper as of 951204]

3. Ontological Prerequisites

Emergent Meta-Systems presuppose a nonduality such as that described in the last section. In this section we will seek to build a bridge between Western Metaphysics and the anti-epistemology and anti-ontology that flows from the non-dual approach. This is to say that non-duality assumes that forms are empty. This kind of assumption is alien to western metaphysical constructions that instead assume Being as the ground of all things. However, we are driven to this alien position of anti-epistemology and anti-ontology by our insistence on exploring Emergence as a phenomena and attempting to model it under the rubric of EMS. This is because Emergence as a phenomena within our tradition focuses us on the borderline between form and no-form as this is the place from which genuine new things arise. And so it is for this reason that emptiness and voidness enters into our conception. As long as we avoid looking at genuine emergence we can avoid looking at the void. But as soon as we enter into any deep exploration of emergence then we are suddenly confronted with this alien landscape which like a Chinese painting shades into the blank paper which appear as the substance of the clouds within the representation.

It is fortunate that we are starting with Goertzel's concept of the Magician SGS as the basis of our extension into Emergent Meta-systems because these meta-algebras are in fact designed to capture exactly this point of emergence as explicitly as possible. Goertzel has an interesting way of looking at the world which categorizes it into four aspects:

The first aspect is what he calls the Inverse Meta which is what the Magician SGS is meant to represent. It is the point of structuring of form at the edge of formlessness. In many mystical texts this formation is called the Kosmic Atom. The

Kosmic Atom is a source form which is embedded in the collective unconscious that shows us the unfolding and infolding of forms out of the void. It appears in Yates in his Vision as his Gyres. It is normally represented by two helixes one inside the other where the twisting of the helixes form mobius strips. In the Kosmic Atom the concept is that every atom of the universe and the universe as a whole has the same form. So there is some concept of the fractal nature of existence. In Goertzel's vision of the Inverse Meta he sees a set of spheres in which each sphere is sucking in all the other spheres and then reconstituting spewing them back out reconstituting the set from within each of the spheres acting in concert. After some discussing of this vision of the Inverse Meta it was realized that this image of the sphere could be represented by a tori that was involuting. The tori would be involuting on one side and exvoluting on the other. It would be embedded in a higher dimensional sphere as its equator. It turns out that in this model there is something special about spheres of dimension two, four, and eight. That is these are the only dimensions in which you can form regular tangent spaces smoothly, i.e. these are the only dimensions where the tori can be joined without singularities appearing. It turns out that this feature of higher dimensional spheres is equivalent to the division algebras from which derive the special systems. Therefore, we can say that starting from Goertzel's model of the inverse meta as involuting spheres or tori we immediately get the fact that there are certain dimensions where the spheres or tori fit together perfectly. That fittingness is the structure of the division algebras that account for the resonance of multiple tori within a single meta-tori that can be seen as a multiply connected surface. The Inverse Meta has a nature similar to the Li discussed in the last section. It is the origin of order within the universe from a space of higher logical type. Inverse Meta means the opposite of meta which are higher logical types in Copi's scheme. In the higher logical type space there is a pattern making mechanism in which the swarm of magician SGSs work together to create each other in such a way that everything is taken in and reorganized and then manifested again anew.

The next aspect of Goertzel's categorization of things is Randomness which is seen as incomprehensible order such as that which arises in ultra-complex chaotic systems. This principle is seen as the shaping-shaped that combines with the Inverse Meta to produce the creativity of the world. In Chinese parlance this would be similar to the Chi or in Buddhism to the Karmic wind. It is a dynamic principle instead of an ordering principle.

Goertzel has a simple equation in which he says that Creativity = Order plus

Randomness. Thus. the world is generated in all its variety, richness, and subtlety through the interaction of these two principles. The primary realm we are talking about is the mind and society. Goertzel is a cognitive psychologist so all of his models represent the Mind and its operation. But he is one of those psychologists that recognize that within the mind there is a social element something like Minsky's Society Of The Mind. So the super-space above the higher logical type space is the overlapping of social and psychological phenomena that appear within the world. That phenomena is characterized by complex adaptive behavior driven far from equilibrium and bordering on the edge of chaos. Goertzel describes multi-lobed strange attractors that order the complex social or psychological phenomena. In the Higher Logical Type space of the Inverse Meta and Randomness as incomprehensible ordering dynamic that drives the phenomena that appears as complex adaptive systems in our social and psychological world. Goertzel developed the Magician SGSs as a model of the Inverse Meta embodying a strange attractor through the interaction with Chaotic Random-Order. These powerful principles together order the Shih of Social and Psychological eventities.

This kind of model is precisely where we would like to start in any attempt to understand emergence. It points toward the void through the chiasm between the Li and Chi and their formation of the chiasmically social/psychological Shih. We can characterize this in terms of what will be called the four different kinds of Being. The different kinds of Being together are our means of coming to terms with non-duality within our dualistic tradition. They have arisen in modern ontology as a result of a phenomenological analysis of being-in-the-world by philosophers such as Husserl, Heidegger, Merleau-Ponty, Derrida and others from continental philosophy. We will give a short introduction to the four kinds of Being by relating them to Goertzel's categorical model.

Figure 217:

- Level 0 = beings, things, entities, facts, states of affairs
- Level 1 = Pure Presence Being == Social and Psychological aspects
- Level 2 = Process Being == Randomness Shaped-Shaping Force
- Level 3 = Hyper Being == Inverse Meta
- Level 4 = Wild Being == Chiasm of Randomness and Inverse Meta

The four different kinds of Being are meta-levels in relation to each other. Each one is more difficult to understand as we ascent the hierarchy until we get to the fifth meta-level which is impossible to grasp.

Pure Presence Being is what we normally think of as Being within our tradition. It is the highest concept that applies to everything as described by Parmenides, Plato and Aristotle and taken unchanged down through the tradition. It is epitomized by the reversible theories of dynamism in Physics. It is the Being of Descartes, Kant, and is assumed by Husserl as the basic mode of Being which underlies transcendentalism. We can characterize it as an illusory continuity that allows ideas to exist as objects in the mind. The mind itself is this stream of illusory continuity that underwritten by all idealistic systems of thought.

Process Being has always lived in the shadow of Pure Presence Being as a kind of Counter Culture. It was first identified by Heraclitus and then was taken up again by Hegel, Bergson, and explored by Husserl in terms of Essence Perception (Eidetic Intuition) and Internal Time Consciousness. Heidegger building on Husserl's work based his whole philosophy on the contrast between Pure Presence Being which is atemporal and Process Being in which Being And Time are mixed. This is the essential Being of Thermodynamic Irreversible Processes far from Equilibrium that are discussed by Ilya Prigogine in Order Out Of Chaos. Thermodynamics always implied that time has a direction by pointing out phenomena in which entropy increases. Recently with Prigogine's work we see that entropy can also have a negative sign in some special cases of irreversible processes. These are of course the most interesting cases as they are the ones that support the existence of life as a far from equilibrium near the edge of chaos phenomena. As Prigogine says all these processes have their own internal time similar to the Internal Time Consciousness explored by Husserl and Heidegger together. These thermodynamic processes are best described by probability and randomness. And it turns out that any isolated system will tend toward an entropy maximum. It is only in special cases where we notice that there is an increase of order within systems that are not isolated and are driven far from equilibrium by energy inputs from the environment. In those cases the mechanism that produces randomness is reversed to produce instead highly improbable order production instead. As Goertzel notes Randomness may mean order that is just too complex for us to understand. Thus Randomness is a projection we make on data. The data may be ordered but we cannot see the order because it spans to large a space or time interval. Therefore in Randomness lies the unknown source of Emergence of new order. This is the creative principle Goertzel invokes to drive his model of the Inverse Meta. You notice that Goertzel thinks of Randomness as a shaped/shaping force. Basically this says that we are below the level of objectification and the separation of subject and object. We have entered a non-dual realm in which the object or subject cannot be distinguished. Heidegger

talks about this by identifying DASEIN (being there) as the nature of the human being prior to the separation of subject and object relations. Processes have this same kind of non-dual structure in which the transformed and the transformation cannot be easily untangled. Processes are connected with technology that underlies the production of illusory continuity. We ignore the technological basis as long as it "works" and only notice it when it breaks down. Goertzel wants to describe chaotic processes. But chaotic processes are not continuous but instead are mixtures of continuity and discontinuity.

Hyper Being was discovered when it was realized that processes are segmented with discontinuities. These discontinuities cannot be understood in the same way as the patterns of the processes. The segmentation of processes often follow a different rule than the content of processes within their continuous regime. Fegienbaum discovered that there was a law to this segmentation when he found that there was a constant that controlled bifurcation of the far from equilibrium process as it headed toward chaos. Therefore when we bring chaos theory into play with continuous processes we find that we need a new theory that accounts for the segmentation of processes. It is Goertzel's aim to produce such a theory by assuming discontinuity instead of continuity in his model of the magician SGS. The magicians through interaction, nomination, and voting produce the segmentation of their own lifecycle and this segmentation is prior to the production of continuity that happens socially through collusion between magicians that help each other produce each other from one lifecycle duration to the next. Hyper Being was first discovered by Merleau-Ponty in The Phenomenology Of Perception and defined in The Visible And The Invisible. It was recognized by Heidegger as Being (crossed out) in his essay "Over the Line." It was taken up and fully explored by Derrida in such works as Of Grammatology and Speech And Phenomena or Writing And Difference. Derrida calls Hyper Being the differing/deferring of DifferAnce which he finds in the counter culture of writing as opposed to the Logocentrism that exalts speech within our culture. The production of a formal model of chaotic processes that assume discontinuity and call for the explanation of continuity instead of the reverse is Goertzel's real contribution as it takes the vaguer philosophical notions of Hyper Being and gives us a very precise meta-algebraic formal model. Goertzel presents this model as the basic mechanism by which his Cognitive Equation works. So it is seen as a model of the Mind. But that model arose from his vision of the Inverse Meta which is an archetypal source that indicates the boundary between form and no-form. This boundary is the most fundamental of all discontinuities. All discontinuities we find within the world point back to this primal discontinuity

between form and void. It is the threshold across which the emergent eventuality comes into the world. That is to say the incomprehensible order hidden in chaotic randomness becomes comprehensible when it crosses this threshold. We may also think of Hyper Being as being related to Possibilities and fuzzy mathematics. The realm of possibilities is purely disconnected as opposed to the realm of probabilities that are bound to unity of actualization. Possibilities do not have to add to one. There are myriad possibilities that are all arrayed in discontinuous segments that coexist. Normally they are thought of as parallel universes in which each possibility is realized.

Wild Being is the hardest to understand because it is the highest meta-level of Being. It is right on the edge of what is comprehensible to us. In Goertzel's scheme we can think of it as the chiasm of the Inverse Meta and the Random Shaping/Shaped force. We know that these two like Li and Chi are one thing. But it is very difficult to understand how. We can think of Wild Being as the incomprehensible combination of order and disorder. We see this incomprehensible fusion in Chaos that is not totally disordered but has unexpected streaks of order. Wild Being is the realm of propensities, tendencies, and the "lines of flight" of points toward infinity in the Mandelbrot set. Deleuze and Guattari use the phrase "line of flight" in their attempt to produce a philosophy at this meta-level. We find this philosophy in Anti-oedipus and A Thousand Plateaus. In those books they define the Rhizome as a network without beginning and end and with no tree-like hierarchies. This is their model of Wild Being. Another good example is the philosophy of John S. Hans in The Play Of The World where a less extreme philosophical view based on the generalization of playfulness of all things is expressed. Deleuze and Guattari express similar sentiments in their definition of the desiring machine that has no meaning but just "works" and is not differentiated from human beings and any other kind of machine. This dehumanization of Playfulness and the non-differentiation between human partial objects and machines of any other kind is a continuous theme in philosophies at the level of Wild Being because this is the point bordering on the absolute non-duality of the void. Merleau-Ponty expressed this in terms of his concept of Flesh which is chiasmic and reversible. We see the absolutely non-dual through the eyes of reversibility right at the last point where comprehension is possible here at the highest meta-level. Goertzel only indicates this level through the implicit chiasm of his two fundamental ordering/disordering principles. However, when we analyze his Magician SGS we see that it is a synergy of all four kinds of Being. Propensities appear as the social field of collusion. We can understand this field of collusion through Coutu's Tendency in Situation (TINSIT)

which is the fundamental constituent of the social field. Deleuze and Guattari call this social field the Socius and pretend that the individual has no existence but see instead only desiring machines floating in the social field called the "socius." We calculate the propensity by multiplying the fuzzy possibility by the stochastic probability. When we treat these two numbers as a vector then we have what is called a Hyper Number. But when we collapse them through multiplication we get the propensity which is what transforms the possibility into the actualization described by the probability. Propensities therefore are very important as they are what connects endless discontinuous possibilities to discrete realized actualizations bounded by probabilities. Over these actualities the determinate idealizations float in the illusory continuity that is the fantasy limit of all measurements.

In the world, there are theories or situations in which all four of these kinds of Being appear in synergy. When we see those synergies we are looking at a manifestation of the Kosmic Atom within existence. Goertzel's theory of Magician SGSs is such an example. But there are many others. Another prominent one is the theory in physics of virtual particle creation and annihilation. If this theory is analyzed we see the combination in it in a different way of the four kinds of Being. Synergies of the four kinds of Being indicate emergences out of the void. This is because every emergent eventuality must pass through all four meta-levels in order to be a genuine novelty in the world. What is happening if something passes through all the meta-levels of Being is that we know that it must have originated at meta-level five which is incomprehensible. The incomprehensibility of meta-level five allows us to associate it with the void. This is because the emptiness of the void is non-experiencible and non-conceptualizable. Basically the void is unthinkable. And what appears from it is unheard of and astonishing when it first appears. That is why we call the emergent eventuality a novum. It is the equivalent of a nova star to the intellect. Thus every synergy of the four kinds of Being indicate the void or the boundary between form and no-form.

But we can say that because Goertzel does not explicitly treat Wild Being that his Magician SGS as we said above does not embody the most radical form of creativity or novelty: That is the novelty of a new individual of a new kind orthogonal to all other kinds and individuals that exist prior to the emergent event. Self-generating systems do not take into account the essential otherness that is necessary for a genuine emergence. What we need is a balance between self-generating and other-generating that allows the system to create new order based on the arising of new individuals of new kinds spontaneously. Emergent Meta-Systems

fill this role of extending magician SGSs to the limit of what is comprehensible by explicitly including the chiasmic structure of Wild Being.

Goretzel's great contribution is to give us a meta-algebraic model of the archetype of the Kosmic Atom that points to the interface with the void. But what we want to do is see that the Kosmic Atom is itself a model of the process of emergence and itself comes into existence. The coming into existence of the Kosmic Atom itself is not included in Goertzel's model. That is why we must move from Self-Generating Systems to a meta-system centered formulation used in defining the EMS. We note that the only difference here is whether the SGS completely dies out between lifecycles. If it does then this radicalizes the assumption of discontinuity. This causes us to provide an auxiliary explanatory structure to bridge this unbridgeable gap. The bridging of the unbridgeable gap causes us to create a super-rational Koan like structure in our theory. It is that structure that points directly to the void. When we have located the void (the fifth meta-level of Being) then there we see the process of radical emergence by which the Kosmic Atom itself comes into existence. This is a very ancient concept. We find it first in Egypt as its first religions tradition preserved in Memphis where we see Atun arise from the mound above the eight primordial gods (ogdad). This Atun later in Greek hands became the Atom the primordial unity of matter. The separation of the Atun from the primordial eight gods is a very significant primal scene as we will see when it is linked to the octonion structure of the fourfold. The atun is at the same time the arising of the Universe in which we live. That universe has just the right cosmic structure to make life possible. The universe is one of a sea of possible universes that are not unlike the atoms of our universe except one is assumed to be all the same and the other is assumed to be all different. This relationship between the primal structures on the highest and the smallest scale related by a fractal differentiation is the meaning of the Kosmic Atom. Goertzel's model describes this in a non-geometrical way using meta-algebras instead.

However, what we see is that the Kosmic Atom archetype must itself emerge and the phases of that emergence are structured by the different kinds of Being. In fact, we see this trail of emergence in the arising of the system from the meta-system by passing through the different special systems stages. Thus what we see is that there is a basic unfolding structure that integrates the meta-levels of Being as the separators of the different stages between meta-system and system moving step by step through the special systems.

Figure 218:


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Meta-system (sedenion) [general economy] pure complementarity
|
|--- Wild Being (chaos)
|   Reflexive-system (octonion)
|
|--- Hyper Being (possibility)
|   Autopoietic-system (quaternion)
|
|--- Process Being (probability)
|   Dissipative-system (complexnion)
|
|--- Pure Presence Being (determinate)
|
System (reals) [restricted economy]

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This process appears in the primal scene of Egyptian relation as the separation of the Atun as "system" from the background of the mound. Within the mound we see the eight primal gods that appear in pairs so what we can see embedded in the eight the four pairs or alternatively we can see the two male and female principles. So the whole chain of symmetry breakings is preserved in the ogdad below the surface of the mound. This same primal scene is preserved in the Kosmic Atom which is Goertzel's view is modeled algebraically by the Magician SGS. But we have shown in a previous paper that underlying the operations of the Magician meta-algebra are the division algebras loss of properties at each stage moving away from the full ordering and full properties of the reals and imaginary algebra. So within the meta-algebraic model as an implicate ordering is the differentiation of the division algebras as described by the Cayley-Dickson process. This is the process by which Heidegger's Fourfold unfolds the world. It is a fragmentation of mutually mirroring slivers of reflective glass. Onar Aam calls this full structure the Magical Mirrorhouse. It has a very complex algebraic structure that he has been exploring. The point is that hidden within the model of the Kosmic Atom in the meta-algebraic version produced by Goertzel steps that separate the kinds of Being are articulated. And the Kinds of Being as a whole appear in the elements of the theory itself as well. So this model brings together all the elements that show us the process by which the Kosmic Atom itself unfolds. That genetic structure then conditions all other emergent events within our world.

How is the Kosmic Atom itself structured to display the different kinds of Being in synergy?

In order to answer this question it is necessary to have a more precise vision of the structure of the Atom. We can see an artistic rendering of the Kosmic Atom on the cover of ReVISION: A Journal of Consciousness and Change FALL 1982 Vol. 5 #2. But all these artistic renderings still leave much to be desired when it comes to precision. The clearest vision that I am aware of is that of Steven Briggs, Ph.D. a Clinical Psychologist who is in practice in Johnson County, Kansas. Initially through LSD experimentation and later through guided imagery based on the work of David Grove he produced a very explicit vision of the Kosmic Atom which is very similar to the artwork on the ReVISION journal cover. I will attempt to describe this vision based on personal communications with S. Briggs.

There is a source point of white light rays at the center of the atom. From this point each ray of light is a world which emanates and returns to the source point. These rays relate to each other through the double helix structure of the Kosmic Atom. The two helixes have an inner core and outer circumference. The cores of the two atoms form a helix around each other as well. Inside that core is the Full Void. At certain points along the length of the core helix of helixes there are nodal points. From these nodal points universes emerge, differentiate, and then collapse back to annihilate. But also there are universes that do not annihilate but just miss each other setting up a standing wave formation at the nodes. This standing wave formation arises within the full void where the seeds of the universes are stored between emanations. As we move from node to node we can follow the outer helixes as they move between the Chakra like nodes. When we follow the outer helixes we find that at each stage there is a twist of the mobius strip between levels so that there is only one side to the ribbon of the helix. But every other loop causes us not to twist but to go through a region of discontinuity between sections of the Penrose triangle. Thus the whole structure has global incoherence and local coherence around each node. Around each node there is also local distinction but global non-duality given by the fact that the helixes are mobius strips. As one moves along the ribbon of the helix to higher and higher levels there is the feeling that one is moving from one meta-level to the next. When one goes through all seven of the meta-level nodes one starts over from the bottom again and the whole structure appears to be at the next meta-level. Thus the structure allows one to move between meta-levels forever, as one cycles around the helix. The Kosmic Atom has no inside nor outside, no top nor bottom. It is itself the standing waves around the point of origin and return of all the universes.

When we compare this to the Emergent Meta-System we see an important point

which is that the full void is the place where the seeds of the next lifecycle is laid down. Out of this full void the seeds fructify, then interact, then nominate candidates for the next lifecycle (and anti-candidates). After annihilation occurs then the seeds of the next span of the lifecycle are placed in the full void. The nodes of the Kosmic Atom are the places where these seeds are laid down and from which they arise again. The seven nodes (Steve Briggs does not specify this number but we are here assuming that they would match the Chakras) are thus the successive incarnations of the seeds from different lifecycles. Annihilation destroys the even and leaves the odd. The odd create the standing wave structure that approximates the structure of the Octonion which is itself an odd exceptional and unique mathematical structure. Moving between nodes we have the helix structure which has the form of a mobius strip signifying non-duality. But every other bridge between nodes instead approximates the Penrose Triangle which establishes global Incoherence and local coherence. Thus we can see that the absolute non-duality of the Kosmic Atom is a chiasm between the duals of the Mobius strip and the Penrose Triangle. This is what prevents us from representing it. At the center of the helix perhaps on a deeper level is a single point from which arise all the universes and to which return all the universes. The Kosmic Atom itself acts as a standing wave in this involuting structure of all the universes being created and destroyed. There exist the following levels of reality:

Figure 219:

White Light
Flickering Light
Source Form
Shadow of Source Form
Shakti
Disillusion of Maya
Maya
Purification State
Being
Awareness
Imagry
Thinking
Emotions
Body

White light is what emits from the Out-of-Time source point. The white light flickers as the universes are created and destroyed in each moment. The Source form is the Kosmic Atom which is non-dual and exists to point to the boundary between form and no-form. But what we actually see is the shadow of the source

form which we are representing here as a double intertwined helix. The pulsing energy of that shadow is Shakti, Chi, or Luft. From the Out-of-Time source (Jabrut) comes light which is deeply ordered and that ordering can be thought of as the Li. The Out-of-Time source is the origin of all causation, there are no secondary causes. The source form exists in the realm called the Malikut in Sufic parlance. This shadow of the mundane world cannot be seen as long as the mundane world is visible. The mundane world is an Illusion that obscures our view of the underlying world of sources. It is only when we become disillusioned with the illusion of Maya that we can enter that other abode. Within the Mulk (mundane world) there are many other levels such as those listed above including the level where Being, the mechanism of presencing of illusion, appears.

This vision of the Kosmic Atom allows us to see that it has a deep structure that is fairly complex. We see in this complexity the basic logic of disconnection between the realms of Mulk, Malikut and Jabrut. The Mulk is the mundane world or the in-time realm. The Malikut is the realm of source forms or the endless-time realm. The Jabrut is the realm of pure power of the single source or the out-of-time realm. None of these realms can be seen at the same time. They are radically disconnected. You see either Mulk or Malikut. When they vanish then the Jabrut may appear. The Jabrut is in this case represented by the out-of-time point from which all the universes emanate and later return. The Kosmic Atom itself exists in the realm of sources called the Malikut. It is not representable but exists in a completely non-dual state. We project upon it the forms of helices and the general form of the Kosmic Atom. Different people make different projections. The projections of Westerners are conditioned by the primal scene of the Well and the Tree (see [The Fragmentation Of Being And The Path Beyond The Void](#)). Emptiness is the difference between the fundamental realms of experience: i.e. Mulk, Malikut, and Jabrut. Thus emptiness separates the sources from the things. Also emptiness separates the sources of things from the ultimate source with no secondary causation.

The thing one must understand about Being is that it is the source of Maya or endless illusion. It only exists in the Indo-European tradition. The Chinese and Islamic traditions do not have it as a fundamental concept. Thus in those traditions things arise directly from the void with no intermediary. This arising is modeled by the logic of disconnection between the fundamental realms of experience: i.e. Mulk, Malikut, and Jabrut. But within the Western tradition there is an essential deformation or flaw that places an intermediate stage between the void and things

called Being. This intermediary stage in turn has meta-level stages we call the four Kinds of Being that form a bridge between beings and the fifth meta-level of Being called the Void. The Kosmic Atom is a source form. This means that it is in some sense embedded in the void itself. This means that from one point of view the sources exist and the single source is obscured. But from another viewpoint only the single source exists and the individual sources of things do not exist. However, when we look at the Kosmic Atom from within the western tradition these fine points get lost. Through our experience we see that the Kosmic Atom can be seen as a chiasm between the Penrose Triangle and the Mobius Strip which causes us to oscillate between the incomprehensibility of global non-duality and global incoherence within which we catch glimpses of local coherence and dualistic distinctions. This chiasm between global incoherence and global non-duality is fundamental and can be seen as an image of Wild Being. Within this standing wave of the Kosmic Atom that in turn is composed of meta-levels of reality corresponding to the Chakras there is a continual creation and annihilation of universes which can be seen as the image of Hyper Being. These universes each form a temporal gestalt from their seeds in the full void to their fructification and development to their interaction to their nomination to their annihilation and laying down of new seeds. This temporal gestalt is the image of Process Being. We see the Kosmic Atom as a representation that is frozen in time made up of helixes that intertwine. The frozen picture of the Kosmic Atom that underlies our idea of it is an image of Pure Presence. So we see that all the kinds of Being exist within the representation of the Kosmic Atom even though strictly speaking it is beyond Being entirely. The point is that the Kosmic Atom exists as an emergent event and thus must have the form of a synergy of the Kinds of Being. It is the primal emergent event that organizes before hand all other emergent events within the Western Worldview. This is an ancient structure within our worldview that has been fully explored in the author's book The Fragmentation Of Being And The Path Beyond The Void.

[END OF WORKING PAPER AS OF 951211]

4. Complementarities and the Polarity of the Noumena and the Autopoietic Special System

One way to think about the Kosmic Atom is that it is a standing wave within the interference of different complementarities. So we are reduced to looking at a set of complementary opposites which together give us a super-rational intuition of the general economy of the world. It is Bataille in his Accursed Share as pointed out by

Plotnitsky in Complementarities who develops this concept of the general economy as opposed to the restricted economy. We interpret restricted economy as system gestalt and general economy as meta-system proto-gestalt. And we acknowledge that complementarities are partial systems that are duals and which exclude each other at a fundamental level to the extent that we are forced as Bohr suggests into an anti-epistemology or anti-ontology. In other words the complementarities show us fundamental limits or infobarriers that delimit an intrinsic ignorance about the world. We know of four of these at least:

Figure 220:

simultaneity of relativity -- Einstein
 measurement of quantum mechanics -- Heisenberg,
 Plank, Bohr
 entropy of thermodynamics -- Prigogine
 color of chromodynamics (non separation of quarks) -
 - Gel-Mann

These complementarities are found to be fundamental in physics. The world does not stop here but produces all kinds of complementarities out of the Meta-system. This is because the creation of exclusive duals is the rule of nature. This is why we use the term eventivity. The wave/particle duality is just one of the myriad polar opposites produced within creation. Creation is a cornucopia of such formations which well up from the void. The void is represented by the exclusivity of the complementarities. When we construct them we are pressing our faces against the glass of the unknowable.

Now what I wish do do in this section is show that we can construct a model of the autopoietic system from the four fundamental complementarities of physics. In other words the autopoietic system is the interference between the four most fundamental physical infobarriers:

measure entropy simultaneity non-separation

This is an elaboration of an idea presented by Prigogine in Order Out Of Chaos. There he suggests that that entropy is a form of complementarity in thermodynamics like that in relativity theory and quantum mechanics. It was Lohmus, Paal and Sorgess in Nonassociative Algebras In Physics that coined the term infobarrier for complementarities and suggested that the non-separation of quarks is another example. So taking this together we see that Autopoietic systems

derive their strange properties from being set over the this paradoxicality that exists in nature as a knot of interference between the different paradoxes. Now we will note that color or non-separation of quarks are a low level phenomena that is very different from the other more macro-phenomena. Therefore we will consider the set of complementarities to be a broken symmetry that breaks non-separation off from the other complementarities. This appears as the fact that the autopoietic system appears as a unity, ie. non-separable and this non-separable unity is articulated in the other three complementarities. We will also assume that the other three complementarities form a quaternionic like structure of imaginaries so that their inter-relations are also meaningful as well as the separate complementarities. Thus we see that each complementarity has a specific meaning with respect to the autopoietic formation and that they interact with each other to form a quaternionic Hyperset like structure that we may describe following George Leonard in the Silent Pulse as Holoidal, that is like a meta-hologram that is interpenetrated.

So let us look at the individual complementarities and see how they describe the autopoietic system. The first is the measure complementarity that says that one cannot measure the velocity and momentum of a particle at the same time. So we can only measure one at a time and the other remains forever unknown no matter how tricky we try to get. This measure complementarity is related to the fact that autopoietic systems are closed to observation. All such systems are cognitive/living. In other words the cognitive aspect is fused to the living aspect. Outside observers cannot tell what such a system will do because its internal state might dictate any reaction given a set of inputs. Output is based on the relation between internal state and the hysteresis of maintaining homeostasis. So we can only really think about an autopoietic system in terms of probability distributions of inputs and outputs. Thus we can only see inside the system or outside of the system never both at once. So our measurements can never be deterministic. This fuses the observer with the autopoietic system under observation. And it fuses the internal cognitive function to the living function of the autopoietic system. Thus the measurement complementarity is well applied to the autopoietic system.

The second complementarity is simultaneity. That is the simultaneity of Relativity theory which says that you cannot know what is happening in two separated points in space simultaneously but must wait for the finite speed of light to know what was happening at both places. We already know that this feature of relativity theory applies to autonomous systems. Where there is no global clock different agents have a problem knowing what time it is and how to coordinate their actions. This

appears in autopoietic systems as the problem of resonance. In order to communicate and become one two dissipative systems must form a resonance and through that become an autopoietic system. But how do you form resonances when you are limited by the finite speed of light signals. The answer to that has to be that for any given autopoietic system time must flow backwards internally. This means that the system must have its own internal time different from external time that has a reversed flow. That reversed flow time stream allows the system to review backwards the timing of the other and project the point in time of resonance forward. This also works between autopoietic systems when they form reflexive systems made up of two symbiotic autopoietic systems.

The third complementarity has to do with entropy production. As Prigogine says you either know the initial state with infinite information or you know the phase state map. The complementarity is that you cannot know both at the same time. This creates a strange kind of entropy that can become negative in certain circumstances in far from equilibrium systems. This appears in the dissipative system as order from nowhere that erupts to cause dissipation. It appears in the autopoietic system as two streams of order from nowhere that balance each other. The autopoietic system uses this order balancing to organize itself and maintain that organization.

These are the three complementarities that give the autopoietic system its strangeness when they are brought together and interfere with each other. Basically because the autopoietic system is standing over the intersection of these complementarities it can never be known in any intrinsic way. What we see is its strange external appearance. And what it promises us is that we will never know the inner workings of the entity that has this kind of unity. Yet once we know that this is a model of interacting and intersecting complementarities then it is possible to understand the autopoietic system to some extent in terms of the relations between complementarities. We do this by seeing that the complementarities form a quaternionic holoidal structure.

non-simultaneity non-measurability = neg-entropy

If we cannot be simultaneously different places as once and cannot measure with precision and rigor then as Prigogine then we cannot know the starting state of the system completely as the starting space is spread out in spacetime and contains elements that have both position and momentum. This means that neg-entropy is possible as a fluctuation within far from equilibrium systems. Entropy is not

unidirectional but can take a negative form in far-from equilibrium nonlinear thermodynamic systems. The complementarity of entropy is a product of the combination of the complementarities of Relativity Theory and Quantum Mechanics together when we assume that Quantum Mechanics operates on all scales not just the micro scale.

neg-entropy non-simultaneity = non-measureability

Not knowing initial states or the phase space of a system and not being in all places simultaneously leads directly to non-measurability. Non-measurability says we cannot know both momentum and position. Position is differentiated within the spacetime/timespace Matrix by non-simultaneity. Momentum is the development of position in the way an initial state develops into subsequent states in the phase space. So the very thing that is denied but the non-measurability is the complementarity between simultaneous positions and the complementarity between initial and final states. The complementarity of complementarities yields a complementarity.

neg-entropy non-measureability = non-simultaneity

Similarly the break between initial and final states and the inability to measure completely prevents us from having simultaneous knowledge of different points in the spacetime/timespace Matrix. It breaks our ability to get from here to there via either motion or by a thermodynamic process. These are the only two ways that two points can be linked in time. So therefore simultaneity is denied to all points in the manifold no matter how close unless they belong to the same quantum and thus are undifferentiated.

The reverse of each of these terms above equals the negative.

non-measurability non-simultaneity = entropy

What is interesting is that we can see that there is a non-commutative property of the two complementarities that yield the opposite result. In other words the difference between entropy and neg-entropy is a very subtle property of the non-commutation of the other complementarities in the set. Equally we can get entropy out of non-simultaneity and non-measurability because they ensure that results predominantly diverge. So when we talk about information flow between non-

simultaneous points and the inability to measure these information flows precisely then we find that entropy can be the result, i.e. the scattering of information and the introduction of disorder.

non-simultaneity neg-entropy = measureability

Similarly measurability depends on bringing things that are separate close for comparison. When we do that we assume that we can overcome information loss in a neg-entropic fashion to get a measure. Thus measurability also depends on bringing things that are non-simultaneous together and ordering them.

non-measureability neg-entropy = simultaneity

Finally simultaneity itself is an ordering of points that are non-measureable at a distance. This means that there is a possibility of resonance between these points. This rare possibility of resonance allows order to be transferred from point to point instantaneously under certain conditions. Quantum tunneling is an example of this.

non-simul neg-entropy - neg-entropy non-simul = 2 non-measure

The difference between the two non-commutating aspects of the combined complementarity yields a doubling of the non-measurability. Utter non-measurability is complete randomness.

non-simul non-measure - non-measure non-simul = 2 non-entropy

Similarly if we take the difference between these two non-commutating complementarities we get the opposite of complete randomness which is complete order.

neg-entropy non-measure - non-measure neg-entropy = 2 non-simul

And again if we take the difference between these two further non-commutating complementarities then we get the extreme of non-simultaneity. This is the two way non-simultaneity between two observers that defines the inertial frames.

Complete order and disorder as well as the inertial frames all reduce to the singularity. The singularity can be seen as the source of complete order or complete

disorder. It can also be seen as the source of the division of observers into inertial frames.

neg-entropy non-measure non-simul = singularity = non-separable

All three complementarities at once also define the singularity. We have already seen that the singularity can be seen as a non-separable unity. That unity is either the unity of all order, the unity of all disorder, or the unity of all inertial frames. In any of these cases it puts it outside the normal relations between things within the Matrix.

This may seem like a hodge podge of rules but they are the translation of the quaternion rules. What it shows is that the three complementarities together give us the unity of a singular system that is non-separable. This is the very image of the anomalous autopoietic special system that appears in some far from equilibrium phenomena. Such a system summarizes the different complementarities that exist in the physical universe. But by doing so and creating a theoretical singularity it builds a bridge to Logos. In that we see the fusion between the living and the cognitive that exists in the chiasm of the autopoietic system. The autopoietic system takes us directly into the non-dual realm which is beyond the dualism of logos and physus. It takes us directly to the nomos or ordering that exists in that non-dual realm between the dualistic opposites. That nomos is expressed in the quaternionic formation that is the template for the autopoietic special system which in turn is the form of the paradoxicality of the overlapping multiple physical complementarities. A similar super-paradoxical formation could be constructed in the logos out of other non-physical complementarities. In fact Plato in his LAWS constructs an autopoietic IMAGE of the Second Best City which embodies these kinds of paradoxes.

We can see that each pair of complementarities yield the other one. Also that if we reverse the relation of the complemtarities then because they are non-commuting we get the negative effect. So entropy can change into neg-entropy by reversing the relation of non-simultaneity and non-measureability. The same is true of the other relations which all together form a closed system. Similarly we can see that the difference between reversed pair is double of the other.

Now we can translate this into our threefold reserve when we realize that in the reserve these points become truth, reality and identity and the unity becomes the noumena within the field of Being. So the autopoietic system is mirrored in the

Reserve as the sub-parts of Being in relation to the noumena. The noumena is something that is impossible to see behind appearances. The autopoietic system is impossible to see into within appearances. So the noumena and the autopoietic system are duals of each other.

The quaternion in the threefold reserve combines with the quaternion of the autopoietic system based on the infobarriers to create an octonion structure that combines the spacetime/timespace Matrix within which the autopoietic system exists with the eternal threefold reserves beyond the Matrix.

We can see the autopoietic system as a closed fountain where the water of life continuously recirculates. This fountain becomes overflowing when we go up to the de-centering reflexive level at which two autopoietic systems can produce a symbiotic relation and out of that the ecstasy necessary to project a world. When autopoietic systems resonate we get the formation of the Kosmic Atom.

The concept of overlapping complementarities fits Plotnitsky's ideas of the heterogeneous interactivity and interacting heterogeneity of complementarities that exist within the General Economy. However, he does not realize that these complementary complementarities interact and resonate with each other based on a particular formation mathematical of the division algebras. It is not just that the complementarities form a random rhizomatic grid or network. But that within the network or rhizome there are resonances that form very regular patterns through the process of progressive bisection. In other words the complementarities will form a cascade of symmetry breakings that are all interactive with each other and through their heterogeneity these symmetry breakings create a meta-pattern of resonance that appears as the division algebras. This occurs because this pattern is ultra-efficient and the probabilities of this pattern is rare but if anything gets into that pattern it lasts much longer than any other pattern against the general push toward dispersion that the different complementarities represent. Therefore the rare results in the prevalent general rule that organizes both the physus and the logos due to this unexpected ultra-efficiency.

Now the question that comes to the fore is how to capture this within our Emergent Meta-System formation. It is through the interstices in existence that are created by the complementarities being simultaneously applied that new emergent orders come into existence. The interaction of the complementarities represent the degrees of freedom within the Matrix of manifestation. The noumena and the autopoietic

system form the poles of that freedom. The noumena is behind manifestation and accessed by the quaternion of truth, reality, and identity. The autopoietic system is an anomaly that can stand as a figure on the ground of manifestation and still be impossible to comprehend by any observer. Between these two poles are a tension though which the implicate order produces new gestalts with emergent eventities arising and moving from the pole of noumena to the pole of autopoietic special system. Autopoietic systems as socially resonating swarms are the only things that can SEE the emergent eventities. They arise from the noumena reorganizing manifestation and appear to be recognized by the autopoietic systems acting together socially. This emanation and absorption process is an interval that defines the lifecycle of the emergent eventity. In fact we can model this in terms of the phonon exchanged between the electrons of the superconducting system. The emergent eventity is like the phonon and the noumena and the autopoietic system are like the two electrons. The emergent eventity is an information pulse that reorganizes the lattice of the environment containing perfect information about the new structure of the environment that passes between the noumena and the perfectly paradoxical phenomena of the autopoietic system.

In this way we see that the noumena/autopoietic system together form a social resonance at the reflexive octonion level as well as embodying the perfect information exchange of the quaternion autopoietic level. This is actually an amazing model because it explains the nature of the emergent eventity. Such eventities have three forms:

Artificial Emergence is where the new thing arises out of the conjunction of two already existing things. $A:B=C$

Chiasmic Emergence is where the new thing arises out of the conjunction of two already existing things plus some random extra component. We can see this as merely analogy where $A:B::R:C$ in which A and B are the known existants and R is the Random new element that gives us C as an emergent. We can think of R as a mini-radical emergence that is internal to the process of creating the new thing that is a combination between things that already exist and something that was orthogonal to everything that already existed.

Radical Emergence is where the new thing arises directly from the void as a random fluctuation without any intermediary of the known things.

Radical Emergence might be represented as Void ---> C where C pops out of the void as a random fluctuation that is orthogonal to every now existing thing. We could equally say that C was pulled out of the Reserve.

Goertzel's Magician systems contain Artificial and Chiasmic Emergence. Radical Emergence is a feature of the Emergent Meta-system that is an extension of the Magician SGS.

Now we can think of the noumena and the autopoietic system as the two things that are combined to get artificial emergence. In that case the emergent event is just the time it takes to make that connection. But we can go beyond that to think that some random element might be added to the relation to create the new thing. That random element comes from the overlapping of the complementarities. It is a distortion added by the octonionic mixing between the two quaternions. It comes from their non-associativeness that is added to their non-commutative properties within each quaternion. But we can also understand that that we can see the system as a pure octonion structure without revering to the quaternions that make it up. In that case we can say that a new thing that arises from nowhere is merely an expression of the ability of the octonionic field of the social to produce dissipative pulses spontaneously. Thus at the octonionic level Radical Emergence is possible and in fact that is why the emergent is the sine quo non of the social. It takes a social formation to recognize the radically emergent eventity. The social can produce and recognize those emergent eventities. What is amazing is that G.H. Mead's original insight in The Philosophy Of The Present is vindicated and given a specific mathematical underpinning in the nomos that underlies the upwelling of both the logos and the physis.

[END OF WORKING PAPER AS OF 951214]

5. Complementarities and Emergent Meta-systems.

Now we are in a position to begin attempting to build our model of Emergent Meta-systems. And we will begin starting with complementarities. What we need is a logical model of complementarity. We will construct this model beginning with the process of logical proof. In logical proof we have a sequent composed of antecedent conjunctions that implies succedent disjunctions. In order to build logical complementarity it is only necessary to have a progressive bisection of antecedents and another progressive bisection of succedents in which each pair of nodes are

labeled negative and positive respectively after the symmetry breaking. Now if we reverse the signs on the nodes we have the complement proof structure. These structures are called by Kant antinomies. If you take one set of premises you get one conclusion and if you take the opposite set of premises you get the opposite conclusion. What needs to be emphasized is that the most general structure of both the succedent and antecedent is the progressive bisection and by reversing polarity with this symmetry breaking then we get the complementary antinomies which are duals of each other.

Now what we want to do is connect these to the magician SGSs by realizing that each term in either the succedent or antecedent may be seen as a magician, and the opposite term in the progressive bisection may be seen as the anti-magician. The point of implication can be seen as the full void. The conjunction of antecedents can then be seen as the process of annihilation that leads to the planing of the seeds in the full void. The disjunction of succedents can be seen as the fructification of those seeds unfolding in spacetime as the swarm arises anew after the full collapse of the previous lifecycle phase. We merely posit that the succedents become antecedents leading to a new implication. This transformation of succedents into antecedents occurs in a moment of mutual action between the magicians SGS components. Thus we can relate the antecedent conjunctions to the annihilation operator of the magician system, the implication to the existence of the seeds in the full void, the succedent disjunction to the gestalt pattern formation operator of the magician system, and mutual action between magicians as they are transformed from succedent to antecedent to the mutual action operator of the magician system. Arising from the void would then be related to the creation operator that is added to the Magician System to make it into the Emergent Meta-System. So the cycle of inference or proof is precisely the same as the lifecycle of the Emergent Meta-system extension of the Magician SGSs.

In logic the interaction between logical terms is ignored. But we want to explore the possibility of this interaction because it then allows us to complete the Emergent Meta-System cycle and use the well known process of logical proof as our structure for understanding both complementarity and the arising and destruction of components. When we do a proof in a formal system it is often assumed that we will only do this proof once because the terms will remain stable over time. However, with Magician System and Emergent Meta-System components we cannot be sure that terms will exist in the next moment that exist in this moment of the lifecycle of the swarm. Thus because we have assumed discontinuity of the

swarm in time we must do the proof over and over again iteratively. When we do the proof we know that there are actually two proofs that must be done at the same time. These are the complementary proofs that come from reversing signs. So these two proofs exists like the dual helixes of the Kosmic Atom that intertwine. Thus the cycling through the process of proof will always be inherently dual and will always be different due to the fact that in each lifecycle there is a nomination process by which the through conjunction leads to annihilation. What survives this annihilation process will be the odd MS/EMS components that will seed the full void of implication and will fructify in the next lifecycle of the MS/EMS.

Now the problem with logic as it stands today is that it is too weak to actually handle this process of proof or implication in the way that is necessary to develop the MS/EMS structure. In order to get a robust enough logic we need to follow August Stern and adopt his Matrix Logic. Matrix Logic is based on a fundamental insight that if we use binary truth vectors that it is possible to use the truth tables as matrix operators on these binary vectors (bra or ket) to create a more robust kind of logic that is a super-set of classical logic. This new logic has what Priest calls para-completeness and para-consistency. In other words it has new truth values for neither and both. Applying matrix operations to truth vectors allows us to construct a quasi-mathematical logic and has many profound implications that August Stern fully explores in his book Matrix Logic And The Mind. We will jump to this new level of complexity where Godel's proof does not disturb us due to the fact that para-consistency of undecidability has been incorporated into the logic directly. This means that every magician will be a term in either the antecedent conjunction or the succedent disjunction and this term will be expressed as a matrix logic string of binary truth vectors and Matrix Logic operators.

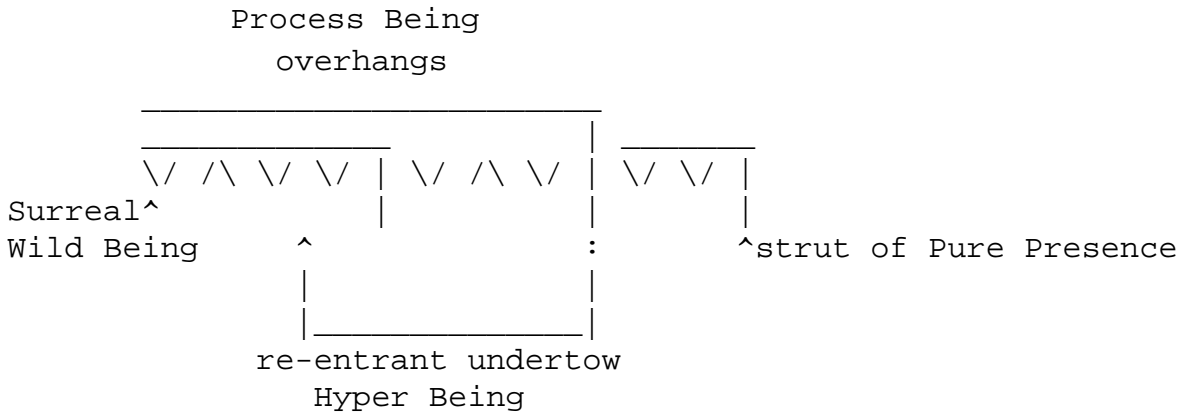
But we note that we have already said that magicians are pulled from a triple reserve associated with truth, identity, or reality. So this means that each term may be triple, and that instead of just truth vectors we also have reality and identity vectors. These different strings of binary vectors and operators may be seen as colored red, green and yellow in order to designate which parts of the term are pulled from which reserve. The reserves may be associated with the full void. The creation of the seeds may be considered the same as marking magicians in the reserve to be produced in the next lifecycle round. But this exercise does not tell us what the magicians themselves are made of but only how their truth, reality and identity are determined. It should be noted that Matrix Logic allows us a negative one truth value as well as zero and one. This truth value corresponds to the

significance "hidden." We have already noted that emergent events are like the phonons that travel between superconducting electrons in a Cooper pair. The pair in question are the noumena and the autopoietic system. Thus when something is identified with the noumena it is hidden. When it becomes manifest it has some partial truth, reality or identity different from negative one. When it is fully manifest as a contradiction along each of its dimensions, ie with value 2, then it is identical with the autopoietic system. All truth, reality and identity values between negative one and two are part of manifestation to some extent. We have also posited that there is an imaginary reality, truth and identity value in each dimension. These form a quaternion. Each of them refer to diagonalize self-reference. Thus together the dimensions of truth, reality and identity unite to define the self of the enventy in question.

When we look at the Emergent Meta-System itself we can see it as a string of Laws of Form/Pattern aspects that encompass surreal numbers. Goertzel has shown that magician systems (MS) can be seen as Spencer-Brown LAWS OF FORM terms and that the laws of form can give them their proper dynamics. But when we look at thing in the world we can see that form and pattern are chaismatic duals and we must always consider both. One way of considering both is to fill the forms with content. And one form of content that is particularly interesting is the Surreal Numbers of Conway and Kunth. Now what we know of the surreal numbers is that they are a progressive bisection starting from zero and expanding to encompass all the reals and surprisingly the infinite and infinitesimal numbers as well in a natural way. We can think of the surreals as either quantity or quality terms. This is because of the interesting transformation between quantity and quality based on the formula N^2 and 2^N . If we have a Lano N^2 chart of the entities in a system along the diagonal of a matrix, then the intersections off the diagonal are the number of possible two way relations between the things. If we interpenetrate these things we get instead 2^N which is the number of possible of qualitative states of this system. The successive levels of complexity of these possible qualitative states appears as the Pascal Triangle. It marks the successive levels of the interpenetration of all things within the void. Now if we look at it we see that the qualitative states can be represented as a progressive bisection that mirrors the surreal quantitative bisection. This mirroring can be seen as another image of the antecedent conjunctions and the succedent disjunctions of the proof structure. Thus in order to get the material substrate of the Emergent Meta-system components we take a similar rooted tree to that we employ in our proofs. We could call this rooted tree an dendrite similar to that which appears on an axon cell of the brain. From this dendrite we get a set of up

and down marks that can be interpreted as a qualitative state from a 2^N qualitative heuristic structure OR as a quantitative surreal number. We place this surreal qualitative/quantitative content within the Laws of Form structures thus:

Figure 221:



We note that the LAWS OF FORM as defined by Spencer Brown include explicitly three kinds of Being. The vertical struts of his "marks" represent Pure Presence Being. The horizontal overhangs of his "marks" represent Process Being. And the re-entrant undertows which act like Go-To's and thus give us the differing and deferring of DifferAnce introduce Hyper Being within his formalism. What we note is that between the overhangs and the undertow are the "ups" and "downs" of the surreals. It is the surreals that finally complete the meta-levels of Being and give us a reference for Wild Being within the Laws of Form structure.

Now this is of interest because it is possible to see the surreal numbers as half way between quality and quantity just as the Laws of Form marks are half way between operators and operands. And surreal numbers are also a half way house between finitude and infinity as they encompass both. But the way that they encompass finitude and infinity is strange and counter intuitive. Surreal numbers have an inner fractal dimension of earlier and later as well as up and down. This means earlier and later in the progressive bisection. That bisection goes on to infinity and in fact generates all the Cantors levels of infinitites up to absolute infinity which is incomprehensible. It also naturally generates the opposite of infinity which are the infinitesimals. But the counter intuitive aspect of the surreals is that they do not integrate. This is to say that they are also filled with holes that separate the finite from the infinite. These holes prevent integration with surreal numbers. This is seen as a defect by mathematicians. But is instead a positive characteristics as these holes are the representation of the void within the substrate of illusory continuity.

The illusory continuity in this case is the infinitudes that are separated from the discrete finitudes by the void sandwiched in between them as an interspace. We can take these holes or ghosts as they have been called and manipulate them as if they were numbers because their position within the progressive bisection is well defined. And we can do something more. We can take the whole surface of the surreals treat them like dimensional axes with fractal dimension. So they form a surface of peaks and valleys. The peaks are the infinities and the valleys are the infinitesimals. These peaks and valleys may define irrational numbers OR transcendental numbers. The ones that correspond to transcendental numbers harbor an infinite amount of information just like a strange attractor. So we can see the myriad transcendentals as strange attractors on the surface of the surreals. We can make a mapping between the peaks or between the valleys or between peak and valley to create a strange multiply connected surface out of the surreals. We can extend this multiply connected surface by mapping holes in it to other holes. In this way we produce an image of the general economy that is made up of many increasing or decreasing positive feedback loops represented by the peaks and valleys. And we can see that tori within this surface might be seen as the connected holes. So the general economy of the multiply connected surreal surface, in what ever dimension, contains many tori representing the infolding and unfolding of the Kosmic Atom within the bizarre landscape of miracles and black holes that define meta-system.

Now if we look carefully at this multiply connected fractal surface we see that it is possible to imagine connecting peaks or valleys to holes by some mapping. If we did that then we would produce directly an image of the dissipative system that introduces order from nowhere. In other words the infinite information of the transcendental would be seen as pouring through the hole into the multiply connected surface. This natural image of the dissipative system allows us to construct images of the autopoietic and reflexive system by merely following the Cayley-Dickson process as it goes through its symmetry breaking and noting the properties of the algebras that produces. Thus out of the field of Wild Being imaged here by the Surreals we find the division algebras that are related to our special systems appearing in a very natural manner.

Now we imagine the surreal qualitative/quantitative soup being contained within Laws of Form aspects. But as noted in previous working papers the Laws of Form has a dual called by the author the Laws of Pattern that takes the exact opposite axioms. One of these two dual systems support Kaufmann addition. The other

supports the reading and writing operations of the turing machine. Thus implicit within the Laws of Form/Pattern are both the rudiments of mathematics of form and computational manipulation based on algorithms. This computational form has already been explained in terms of Turing machines with mobius strips for tapes and for communication channels with each other. The Universal Turing Machine (UTM) that encompasses all these specific Turing Machines (TM) is the image of the Meta-System that supports multiple systems within it like an operating system supports applications. In this way we see that we have two images of the Meta-system: either as Universal Turing Machine or as multiply connected surface within the surreals. What is the tapes of the individual turing machines are the mapping from peaks to valleys or valleys to valleys or peaks to peaks or holes to peaks or holes to valleys in the multiply connected surface. Thus we have dual images of the Meta-system and its encompassing of systems. In the multiply connected surface the system can be related to the finite numbers.

The mapping between foci on the multiply connected surface or the communication channels between TM actors within spacetime can be seen as Random in the sense of Goertzel, i.e. perhaps an ordered pattern beyond our comprehension. This random component represents a propensity or tendency. The propensity is a multiplication of fuzziness times probability. It is what turns a possibility into a actuality that can be seen to have a probability. It is the same thing that we see in the "line of flight" (cf Deleuze and Guattari) of points on the complex plane that give us the Mandelbrot set. It is a chaotic spin that is given to seeds of eventities as they fructify out of the full void which makes them actualize this possibility and turn it into that probability rather than some other one of the myriad possibilities. The structure of the Laws of Form/Pattern that closes around the multiply connected surface of the surreals gives us a synergy of the meta-levels of Being. When ever such a synergy of all four meta-levels of Being appear THERE we see the face of the Kosmic Atom pointing toward the boundary between form and no-form. In fact we can see that the structure of the Laws of Form/Pattern actually encompasses the multiply connected surreal surface and then churns it with the jumps of Hyper Being. Each surreal trapped by the relation between process and presence is a point in the multiply connected surface that is walled off and related to other points in other pockets of the laws of form equation. Thus we can see immediately that the laws of form equation IS the mapping of the multiply connected multi-dimensional surreal surface created from myriads of progressive bisections. The map is made dynamic by the presence of Hyper Being discontinuous jumps.

This model allows us to imagine Emergent Meta-System components as strings of mapping formulas that connect parts of the multiply connected surreal surface to each other along with some binary vectors and Matrix Logic operators that designate these maps as having some degree of truth, reality, identity or self-reference.

Emergent Meta-System Component (EMSC)

1. Laws of Form/Pattern string of terms containing qualitative/quantitative surreal numbers

Figure 222:

<< \ / \ / > \ / \ / \ / > < \ / \ / >

2. Terms of Matrix Logic operators and binary vectors related to truth, reality, identity or self-reference.

Figure 223:

—	—
R	R
[T: -1,0] L 1 L [I:1,2] L j	j
0	0
—	—

T=truth

R=reality

I=identity

L = one of the sixteen Perician Logical Operations defined in Matrix Logic by truth table matrix operating or bras and kets.

Operations are always quaternionic in that with labeled bras and kets identified with T, I, or R any two will produce the third kind following quaternion rules.

Figure 224:

-1= hidden

1,1 = contradiction = para-consistency

1,0 = truth

0,1 = false

i = self-reference for Truth
j = self-reference for Reality
k = self-reference for Identity

3. Recognition operators.

EMSCs can recognize patterns via context free grammars in either of the strings 1 and 2 above.

4. Writing operators.

EMSCs can write seeds to the full void and they can also write to a Linda-like tuple space called just for fun the Akkashic record.

5. Mutual Action operators EMSCs can act on each other and themselves with non-commutative or commutative actions.

6. Gestalt Pattern formation operators. EMSCs can create patterns with other EMSCs.

7. Nomination Operators EMSCs can nominate other EMSCs and anti-EMSCs to their mutual potential space.

8. Creation and Annihilation operators EMSCs can be created by reproduction and destroyed externally to the swarm. Destruction internal to the swarm must be via political action in the nomination and voting process.

9. Actor-like message queue and modes. EMSCs can act like Agha-like ACTORS in a computational space.

10. Swarm operators. EMSCs can contain swarms of EMSCS.

11. Environmental operators. EMSCs can have an effect on their environment taking resources and producing other effects.

SWARMS

1. Swarms can create levels and multiplicities either in spacetime or at meta-levels of nothing in the nowhere.
2. Swarms can move from one Goertzel's SEE nodes to another. These are equivalent to computational environmental spaces.
3. Swarms can nominate EMSCs and anti-EMSCs to influence voting patterns.

This gives us a good introduction to the architecture of the Emergent Meta-Systems. It will have to be elaborated thorough creating a specific Evolving Algebra form for the components and the swarm. But generally we will follow the insights we have had in previous working papers into the Heideggarian Fourfold and its relation to the Cayley-Dickson process for creating the Special Systems based on an analogy with the Division Algebras.

To be precise we will begin with the aspects of the Laws of Form/Pattern identified by Spencer-Brown. These are as follows:

Figure 225:

something	<>
nothing	zilch
layering	<<>>
multiplicity	<><>

Laws of form contain the following axioms:

```
<><> := <>
<<>> := zilch
```

The complementary Laws of Pattern axioms have the form:

```
<><> := zilch
<<>> := <>
```

We need meta-operators to show when laws of form or laws of pattern rules are in force. We will use braces "{ }" to denote laws of pattern rules as they are rare.

Figure 226:

laws of form : laws of pattern : laws of form
 < < \ / \ / /\ > { < /\ > < /\ \ / > } \ / /\ /\ \ / >

These set up two very different patterns of relations between the aspects one affirming multiplicity and the other affirming layering. But we are specifically interested not in the relations of transcendence or immanence but instead in the conjunctions of these aspects. Therefore we treat them in a context of the Emergent Meta-System operators

Figure 227:

~ creation, continuity
 ! annihilation, cancellation
 | mutual action ("|" left action; "|-" right action)
 # pattern formation (using parens to associate)

We can follow Spencer-Brown and use variables within Laws of Form equations with the proviso that a small letter will be filled with a surreal value and considered an individual of a certain kind, whereas a big letter will be filled with another Laws of Form equation and will represent an essence.

This way we can define the following operations on the Reserve "R":

Figure 228:

~R := A is the production of a class.
 ~R := a is the production of an individual existent.

These classes or individuals are orthogonal to all others that exist at that moment. So these terms are equal to the following:

Figure 229:

*!~R := A or a
 *|~R := A or a
 *#~R := A or a

We can go on to look at the following operations:

Figure 230:

A~B := C; A and B together form a continuity C
 A!B := C; A annihilates B with side effect C
 A|B := C; A acts on B creating quantum of action C
 A#B := C; A and B form a gestalt C

Each of these are an instance of artificial emergence in some realm of causation.

Chiasmic or Analogical emergence can be show in the following way:

Figure 231:

A!B~R := C; A annihilates B but creates side effect C
A|B~R := C; A acts on B but creates quantum of action C
A#B~R := C; A forms gestalt with B through some emergent novelty

Single operators also have meaning:

Figure 232:

~A := C; Finite A forms a continuity becoming infinite as C
!A := C; A transforms into its antithetical opposite C
|A := C; A acts on itself to create C -- self-organization
#A := C; A forms a gestalt with itself which is C -- reflection

When we add these operators to the mixture of the multiply connected surface by the laws of form/pattern then we get a very interesting mixture indeed.

Figure 233:

< < A > b > ! < C < d > B < a > > # < < < E > F > < a > >
| _____ |
{ < < < < a > | - < b > > A > D > } ~ N < a > < b > # < < C > >

As you can see from this example very complex formula can be build up and then given truth, reality, identity, and self-reference values. These values can be fuzzy as shown by August Stern when a partial truth value is assigned between zero and one. And by creating random strings we can render these combinations of terms probabilistic as well achieving quantum computational power.

This renders Emergent Meta-sysems fairly complex. But we are driven to that complexity by our wishing to model the form of the Kosmic Atom based on the insight that the division algebras are the ultimate form of the Heideggarian fourfold and wishing to place that in the context of meta-systems instead of systems. However, taken together the formalism is very well defined in its broad outlines. We will wait until we have defined it via evolving algebras before we will claim that it is well defined.

[END OF WORKING PAPER AS OF 951215]

6. Emergent Meta-Systems and Systems and Software Methodologies

It has been noted above that there is a modality of the Emergent Meta-System that

is related to interacting turing machines. This aspect has been explored in depth in previous working papers. It has been shown that the Software Design Minimal Methods are slices of a Turing Machine. It has also been proved that certain combinations of minimal methods are dissipative in structure and that they can combine to make 6 autopoietic virtual combinations and 15 reflexive virtual combinations. Three of the reflexive virtual combinations are ultra-efficient, forming a set of ultra-efficient worlds with the form of the quaternions. Now we extend this line of inquiry by showing that there is a way to look at the minimal methods in terms of the Emergent Meta-system formation. This unique viewpoint on the minimal methods from the EMS has far reaching implications. It gives an immediate value to the EMS in a practical realm of systems engineering and software engineering requirements and design. This is an important area of ongoing research due to the fact that systems and their software components are growing in complexity all the time in spite of the fact that humans are having difficult producing systems at the current level of complexity. The dream is to have automated design and requirements systems that make this almost impossible job of creating reliable, fault-tolerant, safe embedded real-time software and hardware systems. We have taken some steps in the direction of defining the four views and sixteen minimal methods for software and systems design of distributed real-time systems. Finding that these minimal methods which were embodiments of information in spacetime are actually slices of a turing machine helped explain the efficacy of design methods in general. And discovering that these same methods that are split between partially ordered and fully ordered viewpoints have a synergetic mode that bridges that gap gives us hope of someday producing effective designs. However, our dream is to produce a version of the minimal methods that will allow us to fully explore the design landscape looking for optimal designs. This is where the connection to Emergent Meta-systems may have its efficacy.

The first point to note is that most of the minimal methods provide a web of external relations between elements that represent the design of a system. But we note that the Laws of Form/Pattern give us a different kind of model stripped of relations in which each EMS component is independent and relationless within the swarm encapsulated in a grid of levels and multiplicities. The components exist like Leibnizian monads within individual cells of the fourfold. Thus we are called to call into question the establishment of explicit external relations. And in fact Evolving Algebras take exactly this mode in their specification of systems, in which relations are reduced to signatures of functions instead of explicit external constructs. So we have some hint that there is a way to posit relations without creating external links

that form a web between monads separated externally by a grid. Within the ISEM languages created by the author this Grid is four-dimensional containing Layers, Strata, Partitions and Tiers. The generic term would be a Plateau. A single architectural element would exist at an intersection of multidimensional plateaus that form the rhizome (using the terminology of Deleuze and Guattari in A Thousand Plateaus) of the design. But as in ISEM the natural inclination is to create external relationships between nodes within the rhizome to produce the architecture. But Emergent Meta-Systems point us toward another possibility that needs to be explored.

If we look at the minimal methods we notice that each dissipative pair of methods:

Figure 234:

DATAFLOW/Petri Net - State Machine

Mapping - Virtual Layered Machine / DARTS

DARTS / Information flow - network - Value flow global - local

Worldline - Scenario / Petri Net - State Machine

Contain some element that has no external relations to establish:

Figure 235:

TASKS alone

Virtual Layered Machine Instructions alone

Worldlines alone

State Machines alone

Variable alone We can take these aspects of the minimal methods and construct a model of Emergent Meta-System agency that builds not external relations. We note that this model emphasizes autonomy. It is composed of a worldline through spacetime of a task that embodies a state machine which fires VLM instructions. This machine would have its own internal variables that it updated itself as it executed. We can imagine such a machine as independent and operating without relation to anything else within the swarm. What is interesting is that every other minimal method establishes relations between different kinds of design elements. But each dissipative set of minimal methods is associated with certain elements that operate independently and that taken together give us a computational model that is complete. This then is how we imagine the Emergent Meta-System components to be operationalized computationally. There is the multi-dimensional grid or rhizome of the swarm and within it there are individual cells that computationally are completely independent. What is striking is that these individual EMSCs resonate

together to form the higher level entity of the swarm despite their independence. We can only imagine that happen if we can see that the different components experience time moving backwards so that they can synchronize with the actions of other components in the swarm. Thus the swarm like a school of fish moves "as if" it were one organism.

Now what we want to describe is how these EMS components may be seen to posit internal relationships that replace the normal internal relationships in an architectural design. If the swarm had external relations between components then the structure would be frozen and static. But instead each Agent projects a set of internal relations between itself and other entities within the system architecture. This allows for dynamism and change as the projections of structural coherence change. And it allows the projection of the entire system to be social as the projections of each of the agents are combined to give an overall projection. This is accomplished in the following fashion. The agents form a hierarchy of agency. Each agent in the hierarchy projects through functions relationships with other system design elements specified by the minimal methods, such as:

Figure 236:

```
dataflow bubbles
datastores
places of petri nets
communication mechanisms
semaphores
mapping nodes
variables
values
```

```
dataflow bubbles  datastores  places of petri nets  communication mechanisms
semaphores mapping nodes  variables  values
```

A specific agent will see so many objects from these classes and will specify a relation exists between them and it using a Lano N^2 diagram. It will also posit that relations exist between elements it can see from its perspective using the same device.

Figure 237:

```
A 011001

0 X11011
0 1X1100
```

```

1 10X101
1 101X01
1 1010X1
1 10101X

```

Here the A stands for an agent at some stage in the hierarchy and the X a design element to which that agent has an internal relation. All the Xs stand for design elements that this Agent can see. It may posit relations between elements that it has no explicit relation to itself if it can see that design element from its limited viewpoint.

Now each agent in the hierarchy of agency will have a set projection squares like this for each kind of architectural element that can exist with relations in the minimal methods. And each level of the agent hierarchy will have a narrower and narrower view. The narrowest view will be a leaf level agent that will project relations on only one kind of element from each type of architectural element, or just a few of different types. or perhaps just one. These signatures would look like this:

Figure 238:

```

X1
0X

```

There would be one such minimal table for each type of design element that a leaf node agent might have a relation to or be positing a relation between two different elements. So for instance we might have:

Figure 239:

```

A1 d1 A1 f10 A1 s11
0d 1d 1f 0f1 1s 0s1
      11f      11s
where d = datastore, f = function, and s = semaphore all
specific design objects.

```

This minimal signature of an leaf node agent will posit some relations between itself and other design elements as well as projecting some relations between other design elements. Higher level Agents that encompass leaf nodes will have a more global view and will have relations to more external design elements and project more relations between design elements. But the views are always specific to a particular agent and from its perspective rather than an external objective view.

Thus we can apply Jumarie's concept of relativistic information in System Information And Subject to the relation between viewpoints of Agents. The objective view is the generalization of all the agent views rather than an ideal view. For this reason we can see it as a social projection of all the agents in the swarm (architectural grid) working together. And we would see each external relation between design elements as fuzzy because each is build up from the individual views of agents.

Any given system would have the following aspects:

- 1) A set of design elements of different types each in its own universe, to use EA terminology.
- 2) The grid or swarm of agents that are Emergent Meta-System Components
- 3) The hierarchy of sub-agents within higher level agents that have more and more fragmented views of the design elements.
- 4) The minimal agents that can only see one design element from each universe.
- 5) The signature of projected binary relations by the agent.
- 6) The fuzzy relations between design elements from the external view that find the max and min of the partial views of the system that may be in disagree with each other.

Now when we look at the signature of an individual leaf agent in its projection of relations between itself and others or just between others we can think of this agent as being created by a genetic algorithm. As such we can apply Kauffman's NK model of the design landscape. In this model each node is a particular permutation of possible attributes. We can relate that to the signature of relations of the leaf agents. We can imagine these leaf agents being created by a Genetic Algorithm such as that described by John Holland in HIDDEN ORDER. In that process each leaf agent would posit connections between itself and other design elements or just between other design elements. Such an agent could have those signatures mutated or crossed through the the genetic algorithm complex adaptive evolutionary process. Multiple agents projecting different internal relations could be produced and could be tried against the fitness criteria of the NK design landscape. Fitness criteria are tied to each node of the NK landscape. These fitness criteria could be seen as derived from Requirements modeling. The cumulatively most fit agents would tend to survive and the whole system would converge on a socially agreed upon architecture for the system whose external representation would become less

and less fuzzy as time went on and evolution according to the GA progressed. So we see here that the GA production of agents with minimal signatures is probabilistic as described by Kauffman while the external system structure is fuzzy that is seen from the viewpoint of an ideal external observer (the designer with a God's Eye view). The fitness numbers would then be seen as propensities that connect the probabilities to the possibilities. Fitness numbers represent external constraints but translated into propensities or tendencies that guide the evolution of the system itself as it designs itself thorough the interaction of Emergent Meta-System components.

This view of design sees the system through the eyes of the individual agents where lower level agents can see less and less of the entire system. It takes for granted that each agent has its own viewpoint on the system and will perhaps see some connections that no other agent can see either between itself and other components or just between other components. If we acknowledge that these minimal agents can be produced by a Genetic Algorithm and that they can have fitness related to the fitness of the nodes in the design landscape then we can see the system evolving a design using the crossover and mutation aspects of the GA. We can always see the external view of the system design in terms of fuzzy relations that maximize and minimize all together the relations posited by the agents working as a social group within the swarm. The swarm itself goes through its discontinuous EMS lifecycle as part of the Genetic Algorithm. In this way the physical architecture would adapt itself to the functional architecture progressively and design elements would come to have their final architectural relations through the build up of fuzzy relations as a side effect of the requirements constraints.

In this way we can get a vision of how the Emergent Meta-Systems can be applied directly to the pressing problem of how Software and Systems Engineering Design is accomplished. Because we do not assume continuity we can imagine how a punctuated equilibrium form of evolution of physical agents can adapt themselves to a functional architecture to produce a perhaps optimal physical architecture of a system all based on the internal projection of relations rather than the external projection by a designer (acting as God). That internal projection of relations would be done as Evolving Algebras suggest using the signatures of functions. In other words relations can easily be posited using N^2 matrices in which the existence of a relation is produced by marking an intersection point. Opposite directional relations are created by marking complementary intersections within the matrix. We can also imagine how agents can be seen to interpenetrate. That is accomplished by allowing

their set of operators to interleave. Thus when an agent is created it may combine a set of operations taken from its parents. A certain set of operations are atomic and others are cascades of sets of operators which can following KOZA in GENETIC PROGRAMMING may form evolving algorithms. So we can see not just the projection of relations of an agent evolving but the algorithmic aspect evolving also. Similarly the attributes associated with an EMS component could be crossed and mutated as well. Thus all aspects of the Evolving Meta-System Component can be seen to take part in the Genetic Algorithm Evolution.

But now we come to interpreting the Laws of Form/Pattern, Surreal Numbers, and Emergent Meta-System operators strings in the context of the methods as we must the use of matrix logic itself. These formalisms that we bring together to give structure to the Emergent Meta-System concept need to be understood within this new context. First we note that the surreal numbers can represent quality or quantity. But we have seen that the signatures of internal relation projection appears as N^2 Lano diagrams while the posting of overlapping operators in a KOZA style Genetic Programming takes the form of 2^N where we get the interpenetration of operator sets. This means that the static relational structure is quantitative in design while the behavioral structure is qualitative in design. These two come together in the positing of the design landscape using the NK model of Kauffman. So we can see that it is the fitness numbers attached to the landscape nodes that are the best candidates for being represented by the surreal numbers. These fitness numbers are neither associated directly with operations or relations. They represent propensities or tendencies that arise based on external constraints. Fitness numbers form a field associated with each point in the landscape. There may be a vector of such fitness numbers associated with different dimensions of the field. The laws of form encompass these fitness vectors represented as surreal numbers. The laws of form/pattern allow us to construct patterns of fitness vectors from across the field. This means that individual agents can use these expressions to look for optima in which the vectors of fitness values are best. The laws of form may be used to connect and manipulate these surreal fitness vectors in equations of embedding and connected multiplicities. We can link these filled laws of form/pattern equations via the EMS operators. They can be created and canceled, they can form patterns and mutually interact. These terms within the whole swarm can follow the course of the proof process as the proofs are continually proved on the whole set of EMS components. This is done by associating the terms that capture the relations between fitness values with identity, truth and reality vectors that relate them to the Evolving Algebra Reserve. This gives us a view of the EMS manipulating the multi-

dimensional fitness vectors that appear over the NK design landscape and connecting that with the evolving of the algorithms via the operations and the internally projected relations.

Such a system if realized would be very sophisticated and would make possible the evolution of physical architectures using the Genetic Algorithms to adapt agents projecting internal relations, developing genetic programs and manipulating fitness vectors on the design landscape within functional and requirements constraints. Whether such a system could be realized is up in the air. But at least we have a vision of how the EMS structure could be implemented to solve the practical problem of evolving system and software architectural designs and this allows the abstract EMS structure to be seen in the context of more concrete yet still abstract Software Design Methods. This calls for a radical rethinking of how we design such systems and the role of agency in those systems which may be to far reaching to be considered do able at our current state of technology. However, this vision of the implementation of an EMS in the domain of architectural design evolution allows us to see more specifically how an EMS functions within a specific context. It has been shown in a separate paper how Magician SGSs are duals of General Systems Theory constructs such as those of Klir in Architecture Of Systems Problem Solving. Emergent Meta-systems are merely an extension of Magician SGSs that take into account radical emergence. Since it has also been shown that Software Design Methods are the dual of General Systems Theory as well we could expect to find a connection between EMSs and Design methods. And in fact we have now shown that such a connection is plausible even though there are lots of details to work out. And interestingly enough this connection gives us a completely different way of viewing the relation of physical to functional design of systems that suggests that architectural evolution systems are possible using GAs.

[END OF WORKING PAPER AS OF 951218]

7. A definition of EMS components in Swarms.

The following definition of a swarm is based on the concept that swarms contain monads and that monads exist within a Grid within a swarm, and that monads in turn contain swarms. The grid is a Cartesian coordinate scheme that is four dimensional producing a series of places for monads to exist. Here it is assumed that EMS components are modeled in terms of Computational Monads. For an explanation see the ISEM2 working papers series that this definition is taken from.

The definition follows the general form of PVS language from SRI.

Figure 240:

```

swarm [sw: TYPE] : THEORY          -- meta-system

BEGIN

grid:          TYPE                -- four dimensional grid
component:     TYPE                -- SGS element as system within
                                metasytem

plateau:       TYPE                -- dimension of grid
node:          TYPE                -- intersection of dimensions
action:        TYPE                -- action of monad
tuple:         TYPE                -- tuple space of swarm
talk:          TYPE                -- talk space of swarm
list:          TYPE                -- a hyperlist
                                same as hyperset (i.e.
                                non-well-founded set) plus
                                ability to have repeated
                                members with an order

chiasm:        TYPE                -- source of quality and
                                quantity

position:      TYPE FROM list      -- place in a list
monad:         TYPE FROM component -- computational monad
seed:          TYPE FROM component -- germ of a monad
viewpoint:     TYPE FROM compoent  -- interiorized monad
candidate:     TYPE FROM component -- nominated monad
level:         TYPE FROM plateau   -- a dimension
partition:     TYPE FROM plateau   -- a dimension
strata:        TYPE FROM plateau   -- a dimension
tier:          TYPE FROM plateau   -- a dimension
quality        TYPE FROM chiasm    -- source of truth, reality,
                                identity in the reserve
quantity       TYPE FROM chiasm    -- source of presence/absence
                                in appearances

truth:         TYPE FROM quality   -- a quality of the noumena
falsehood:     TYPE FROM quality   -- a quality of the noumena
reality:       TYPE FROM quality   -- a quality of the noumena
fantasy:       TYPE FROM quality   -- a quality of the noumena

```

Reflexive Autopoietic Systems Theory

```

identity    TYPE FROM quality    -- a quality of the noumena
difference  TYPE FROM quality    -- a quality of the noumena

presence    TYPE FROM quantity   -- a quantity of the phenomenal
absence     TYPE FROM quantity   -- a quantity of the phenomenal
lv:         VAR level            -- variable of a dimension
pr:         VAR partition        -- variable of a dimension
st:         VAR strata           -- variable of a dimension
tr:         VAR tier              -- variable of a dimension
m, n, o:    VAR monad            -- specific instances of
s:         VAR seed              -- potential monad
v:         VAR viewpoint         -- viewpoint monad
c:         VAR monad candidate   -- candidate monad
nil:        VAR monad            -- zilch monad
R:         VAR monad            -- reserve monad
                                   (cf Evolving Algebras'
                                   Reserve)
g:         VAR grid              -- specific instance of grid
a, b, x:    VAR action           -- particular action
nd:         VAR node             -- specific node
gab:        VAR talk             -- specific speech
tup:        VAR tuple            -- specific tuple
lst:        VAR list             -- specific list
ps:         VAR position         -- specific position
p:         VAR presence          -- specific presence
t:         VAR truth             -- specific truth
r:         VAR reality           -- specific reality
i:         VAR identity          -- specific identity
:         VAR quality            -- specific noumena
-p:        VAR absence          -- lack of presence
-r:        VAR fantasy           -- lack of reality
-t:        VAR falsehood         -- lack of truth
-i:        VAR difference        -- lack of identity

-z:        VAR monad            -- lack of noumena = phenomena
transform: [ s -> m ] -- reflect seed into monad
transform: [ m -> v ] -- reflect monad into viewpoint
transform: [ v -> c ] -- reflect viewpoint into candidate
transform: [ c -> s ] -- reflect candidate into seed

```

Reflexive Autopoietic Systems Theory

```

mosaic: [ lv X pr X st X tr -> g ] -- all node addresses in
grid

collage: [ g -> lst ]           -- all nodes to hyperlist
place: [ lv, pr, st, tr, m -> nd ] -- place monad in node
decomp: [ m -> sw ]             -- decompose monad into swarm
comp: [ sw -> lst ]             -- compose swarm into members
select: [ ps, lst -> m ] -- select monad from list
mesh: [lv, pr, st, tr] -> m ]   -- address monad in grid
%: [ m -> boolean ]             -- absence operator
%m: [m -> false ]               -- make monad absent
%%m: [m -> true ]               -- make monad present
present: [ %%m -> nd ]          -- monad present in grid node
absence: [ %m -> nd ]           -- monad absent in grid node
empty: [ nil -> nd ]            -- grid node empty
~: [ R X m -> m ]               -- creation operator gives any
                                monad from out of field

~m: [ nil -> m ]                -- creation operator gives
monad

m~n: [ m, m -> m ]              -- continuity produces new
monad

!: [ nil -> nil, a ]            -- annihilation operator gives
                                side effect out of field

!m: [ EXIST m -> nil, a ]        -- unique annihilation
m!n: [ m, n -> nil, a ]         -- mutual annihilation with
side                               effect

|: [ nil -> a ]                 -- mutual action gives action
                                out of any field

|m: [ R X m -> a ]              -- mutual action de-reifies
                                monad

m|n: [ m, n -> a ]              -- mutual action produces
action

ma|nb: [ m, a, n, b -> x ]      -- specific actions of specific
                                monads produces action

#: [ nil -> sw + a ]            -- gestalt pattern formation
                                operator produces swarm minus
                                side effect action out of
                                field

```

Reflexive Autopoietic Systems Theory

```
#m: [EXIST m -> sw + a ]      -- gestalt pattern formation
                                produces swarm plus action
                                supplement from one monad
m#n: [ m, n -> sw + a ]      -- gestalt pattern formation
                                swarm plus action supplement
                                from two monads

command: [ gab -> a ]         -- talk becomes action
describe: [ tup -> a ]        -- tuple picture becomes action
liquify: [ m -> a ]           -- monad becomes operator
boast: [ a -> gab ]           -- action becomes talk
paint: [ a -> tup ]           -- action becomes painting
reify: [ a -> m ]             -- action becomes operand
enscribe: [ gab -> tup ]      -- talk becomes written tuple
solify: [ gab -> m ]          -- talk becomes monad
enunciate: [ tup -> gab ]     -- written tuple becomes talk
carve: [ tup -> m ]           -- written tuple becomes a monad
write: [ gab -> R ]           -- write something to the
                                reserve

shout: [ gab -> sw ]          -- talk to the swarm
listen: [ R -> gab ]          -- listen to something from the
                                reserve

socialtalk: [ sw -> gab ]     -- listen to the talk of the
                                swarm

castaway: [ tup -> R ]         -- write a tuple to tuplespace
broadcast: [ tup -> sw ]      -- send a tuple to whole swarm
reelin: [ R -> tup ]          -- get a tuple from tuplespace
deliver: [ sw -> tup ]        -- take a tuple from the swarm
karmic: [ a -> R ]            -- action goes to reserve
effect: [ a -> sw ]           -- action goes to swarm
cause: [ R -> a ]             -- action comes out of reserve
groupact: [ sw -> a ]         -- action comes out of swarm
emerge: [ R -> m ]            -- monad comes out of reserve
                                see also (~m)

skew: [ sw -> m ]             -- monad comes out of swarm
annihilate: [ m -> R ]        -- monad destroyed see also (!m)
eclipse: [ m -> sw ]          -- hide monad in swarm
recognize: [ sw -> lst ]      -- recognize a swarm pattern
nominate: [ SOME m AND SOME -m -> lst ] -- nominate candidates
vote(lst): [ lst -> nil, R X seed ] -- annihilate candidates
```

```

fructify: [ R X seed -> m ] -- fructify seeds into monads
become: [ t, r -> i ]
become: [ t, i -> r ]
become: [ i, t -> -r ]
become: [ i, r -> t ]
become: [ r, i -> -t ]
become: [ r, t -> -i ]
become: [ t, r, i -> -z ]
become: [ -t, -r, -i ] -> z ]
become: [ z -> t, r, i ]
become: [ -z -> -t, -r, -i ]

amalgmate: [ -z -> m ]
amalgmate: [ z -> -m ]

END swarm

```

It is important to note that the EMS operators are complementary duals and that the two dual operators are duals of each other.

Figure 241:

```

~ == ! dual
    ||
    || ----- dual duals
    ||
    ||
# == | dual

```

The main difference between the two duals is that in the first the two elements that are operated on disappear in the operation whereas in the second the elements that undergo the operation continue to stand after their effect has been created.

Thus the creation operator produces a continuity out of two elements into which they vanish whereas the gestalt pattern formation operators does not destroy the elements that produce the gestalt. Similarly the annihilation operator destroys the two elements that are annihilated even if they produce a side-effect. On the other hand the mutual action operator leaves the monads that act on each other intact even as it produces the effect of their combined action. This dual duality is very important and is similar to the duality property recently adumbrated in String theory in physics. Meta-duals express non-duality as do meta-complementarities.

Also in this definition we see that there must be intertransformation between action, talk, monads, and writing tuples. This intertransformation is very important. It allows us to consider the components that arise within the field of propensities to transform as they fall back into it.

Another point is that the Reserve is considered only a reserve for computational monads in this definition but we assert that the Reserve is still a threefold relating to identity, truth and reality as posited before. It is impossible to have a full reserve under the PVS language.

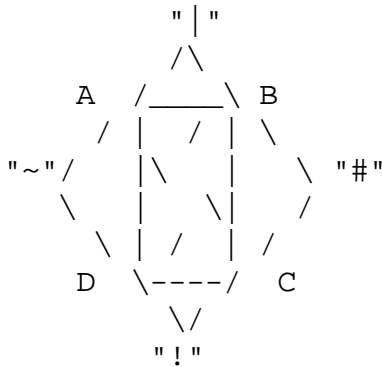
Note that presence/absence is the other fundamental distinction that goes along with those in the reserve between identity/difference, truth/falsehood, reality/fantasy.

8. Mirroring of the Emergent Meta-System

One of the major mysteries of the theory of interpenetration is how the seeds of the next moment are impregnated in the full void in order to fructify in the next moment. As soon as one posits perfect discontinuity this becomes a major theoretical problem. And of course it is solved by positing the Alaya-vijyana or store house consciousness, which is a special realm that escapes the slice of the discontinuity. But this theoretical slide of hand is always unsatisfactory as it begs the question as how the radical discontinuity between lifecycles of the Emergent Meta-System is bridged. There is another answer that must be considered. That is nothing crosses the line of radical discontinuity. Instead there is merely a mirroring of elements across the discontinuity. That is to say that the realms that are being divided by the discontinuity are mirrors. All that crosses the divide are reflections of the things in any one realm into another realm. This is a simple answer that preserves the radical discontinuity and accords well with our model of the quaternions and octonions as reflections. In fact we have posited that the quaternions are reflections in three vertical mirrors and that the octonion are internal reflections in four tetrahedrally configured mirrors. Here we extend this analogy by positing four mirrors that are arranged in the form of a cube. We note that Shea Zellweger has shown that logic has a mirror formation using four mirrors as well. In that case the four mirrors are arranged such that three of the mirrors form an xyz axis and the fourth mirror crosses this obliquely. This arrangement gives the group structure D_4XC_2 . It allows you to do logical manipulations merely by noting the reflections of Zellweger's Logic Alphabet in the four mirrors. We note also that

if we take these same mirrors and create an inwardly mirroring tetrahedron we get the octonion mirroring which is based on the Vector Equilibria. Similarly if we arrange the mirrors in a cube then the mirroring between the mirror surfaces within the cube gives us the kind of mirroring that we propose connects the four different phases of the EMS lifecycle.

Figure 242:



The outer square is the configuration of the mirrors in a cubic formation. The inner rectangle is the reflecting light which is going around in a clockwise direction. Vertices of the outer cube of mirrors are the EMS meta-algebraic operators. Mirrors are labeled A, B, C and D. These correspond to separate phases of the lifecycle of the EMS. Only the reflections move across boundaries. Actual objects do not move across radical discontinuities between mirrors. Each phase of the lifecycle corresponds to a different meta-level of Being.

Figure 243:

- Mirror A is actualization of monads via probability (Procss Being)
- Mirror B is internalization of viewpoints via determinants (Pure Presence).
- Mirror C is nomination and voting on candidates via possibility (Hyper Being).
- Mirror D is insemination of seeds via propensity (Wild Being).

The transition between each mirror is related to one of the meta-algebraic operators related to the EMS structure.

Figure 244:

- Creation governs the transition between seeds and actualized monads.
- Mutual Action governs the transition between monads and internalized viewpoints.
- Gestalt Pattern Formation governs the transition between viewpoints and nominated candidates
- Annihilation governs the transition between Voted on Candidates and the

odd left over successful candidates that become seeds in the next generation of the lifecycle.

We start with the seeds and notice that the seeds form a mosaic or collage whole which we might name the pod. Seeds fructify when the Creation operator is applied to them. They represent propensities in the full void. These propensities appear within Wild Being. When the seeds fructify then actualized computational monads develop which are governed by probabilities. These probabilities are embodied in Process Being. The monads form a swarm. The monads interact with each other through the Mutual Action operator. Through this interaction they each get a view of the response of the other monads to each of them individually. This causes them to become introspective and develop into viewpoints. Each viewpoint forms a separate opinion as to the relations that hold within the swarm. The viewpoints form a constellation. Each viewpoint in the swarm forms a picture of the pattern within the swarm. This pattern may be different from each vantage point. The different pictures are produced via the gestalt pattern formation operator. Each observer with his viewpoint expresses his opinion as to what the next configuration of the swarm should be like by nominating candidates for the next lifecycle spiral. These potential candidates attempt to persuade the other monads that they should exist. Then when all the nominations have been made the annihilation operator is applied. All those candidates that are odd survive the annihilation. The swarm itself may produce wild card candidates in order to skew the election. The set of candidates form a slate. The remaining nominated candidates are reflected in the mirror of Wild Being and thus become the seeds for the next lifecycle spiral.

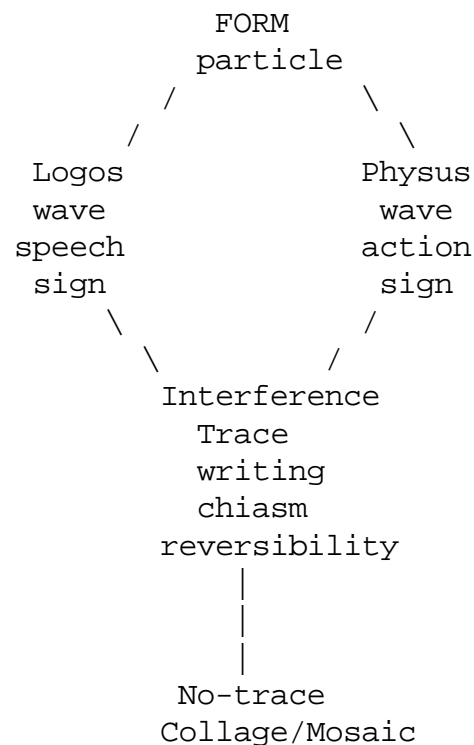
Note that at each stage there is a mirroring of the components in the hyperlist and the application of an operation to the new reflected representation. This application of the operation moves us on to the next stage in the lifecycle. Nothing ever crosses the divide from one mirror to the next. Radical discontinuity of the Meta-system is maintained. Yet the continuous-discontinuous evolution of the Emergent Meta-System also progresses as it spirals round and round between the mirrors. The mirroring of components looks like this:

<i>Figure 245:</i>	
COMPONENTS	COLLAGE/MOSAIC
seeds	pod
monad	swarm
viewpoints	constellation
nominated candidates	slate

But between the mirroring of elements there is a transformation introduced by the meta-algebraic operators between each phase of the spiral.

Now let us be more precise about how this structure unfolds. In each case there is a connection between the components and the collage/mosaic that they are a part of. We can use a familiar structure to produce this connection. We note the possibility of combining the FORM, SIGN, TRACE, NO-TRACE with the distinction between logos and physus in order to get two wavelike formations for each particle like formation which then degenerates into an interference pattern on a substrata.

Figure 246:



We note that it was necessary to posit the Linda-like (Gelertner) tuple-space and Cheron-like (Taylor) broadcast of self talk in order to make possible indirect resonance in our definition of the swarm above. We can relate this distinction to the direct actions of the components in the swarm. So we immediately get the fact that when we apply the logos/physus split to the series of Form, sign, trace, no-trace we get a doubled sign component that relates speech to action and these to the writing in the tuple space. It was also necessary to posit that actions may be translated into

components, tuples, and self talk. Likewise components may be translated into actions, tuples and self-talk. Likewise tuples may be translated into actions, components and self-talk. Likewise self-talk can be translated into actions, components and actions. In other words all these forms of the monad must be intertransformable. The intertransformability allow us to see how the particle like system components arise from out of the collage/mosaic metasystemic field.

We may take this further by constructing four such structures based on the methodological distinctions of Klir, one for each reflective phase.

Figure 247:

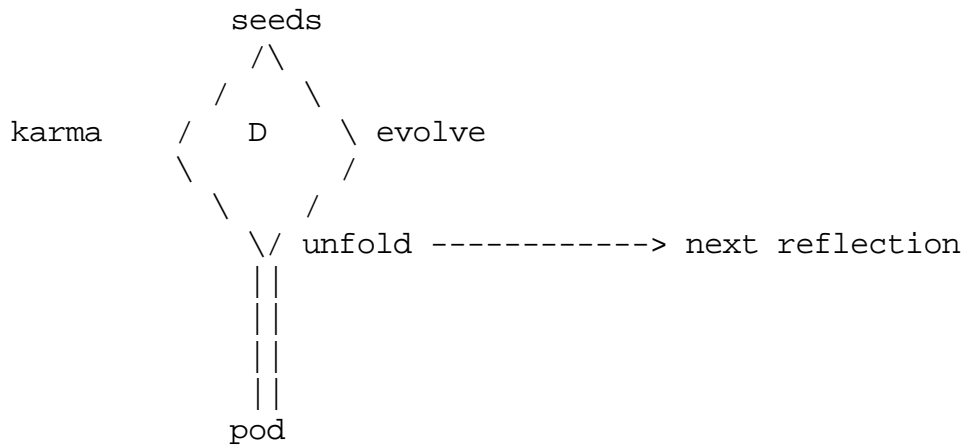


Figure 248:

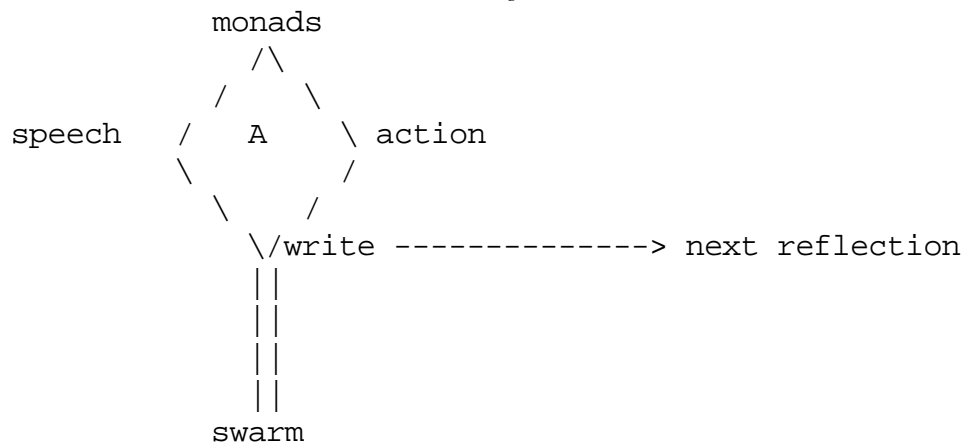
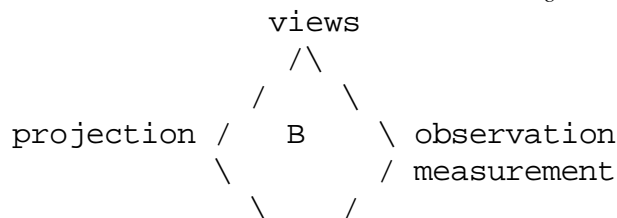


Figure 249:



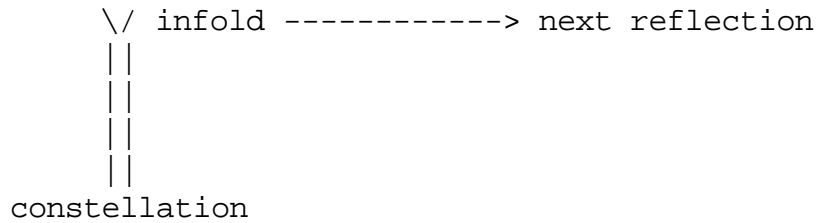
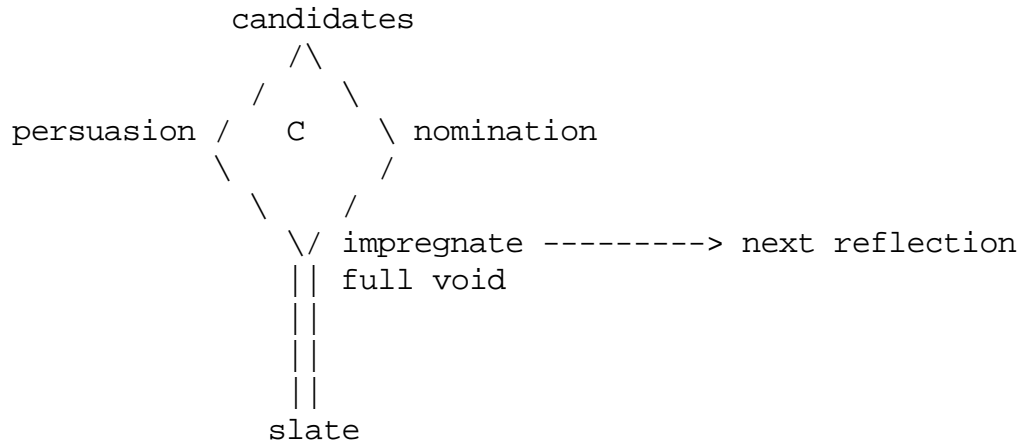


Figure 250:



What this series of structures based on the differentiation of the methodological distinctions shows is that each moment in the reflective spiral mirrors and transforms the one before it but in doing so preserves the essential connection between system and meta-system. Thus the dualism between logos and physis and the chiasm between them is preserved in each reflection. It is out of the chiasm that the reflection of the next moment of the spiral is produced. When the transition between phases of the spiral is made what occurs is an entry into global non-coherence and non-duality as expressed in the duality between the Penrose-Escher triangle and the Mobius strip. We must remember that the meta-algebra of the EMS constitutes a model of the Kosmic Atom. This model as we have seen comprises several moments. One moment is the seeding of the full void in which the helixes of the Kosmic Atom intersect. But there is also the movement of the helixes back out to the periphery and the spiraling of the helixes around each other at the core of the Kosmic Atom and finally the looping of the helixes at the ends back from the periphery to the core. These four moments of the structure of the Kosmic Atom, intersection, turning back in at the periphery, folding through itself at the ends, and spiraling around each other at the core all define the moments of the process of reflection. In fact the process of reflection is a more accurate model as it does not assume that anything moves except the light that reflects within the cube of mirrors. In fact we can relate them in this way. The chiasms within each reflection falls into complementary pairs:

Figure 251:

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unfold -- infold
write (outward) -- impregnate (inner writing)
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We can relate the first of these pairs to the two ends of the Kosmic Atom where it turns back on itself unfolding from one end and infolding at the other. The second can be related to the inner spiral of the helixes as they stabilize what is brought into existence from out of the void. The full void itself can be related to the interference of the light reflecting within the cube of mirrors. These are the intersection points in the Kosmic Atom. And the mirrors themselves give us the relation to the outer spirals of the helix that turn back toward the center giving us the epiphanies of each chakra. The mirrors relate to the global non-duality and global non-coherence. Thus when we look at the internal chiasmic structure of the cube of inwardly reflecting spheres then we see that this structure is isomorphic to the Kosmic Atom. The mirrors represent the limits in global non-duality non-coherence that causes the helixes of the Kosmic atom to turn back in on itself giving the various levels of intersection at the core. The intersections at the core is the general interference pattern within the inwardly mirroring cube. But within this pattern there are chaisms between each opposing mirror surface namely unfolding-infolding related to the ends of the Kosmic Atom and outward and inward writing related to the inward spiral of the Kosmic Atom. It is the chiasmic or non-dual structure of reversibility, related to the structure of reversibility in the Greimas cube that we find as our analogy to the Kosmic Atom. This is because the Kosmic Atom is the archetype for the arising of forms directly out of the void, i.e. radical emergence. This radical emergence is caught in the meta-algebra of the Emergent Meta-System.

In China the image of the Kosmic Atom was the Intertwined Dragons within the mists of the void. In other words there image of the Kosmic Atom was not a dead geometrical figure but instead a live fantastic beast that attempted to capture the pulsation of the Kosmic Atom. When we look at The Propensity Of Things by Francios Jullian we see that the Chinese saw the capturing of the patterning of the form of no-form as their ultimate aim in all their arts. They expressed this in terms of the concept of Shi (disposition of propensities). They saw the dragon within the mist of the void as a field of propensities or tendencies. We have modeled these in terms of Coutu's TENSIT and have showed that this is a social field oriented toward the production and recognition of Radical Emergence. We have discovered that the best model of this structure is the emergent meta-system. The Propensity Of Things gives a very definite view of how propensities and tendencies of situations defined the Chinese way of viewing the world as opposed to the causal Western way of

looking at things. The Chinese traditional viewpoint and their sciences are intrinsically autopoietic in nature. They considered each thing as a closed isolated system and looked for the irreversible processes that may transform it from within. This view of things is markedly Alchemical, as it posits a vessel within which a transformation is triggered if the right set up can be found. Triggering internal irreversible transformations given a particular set up is the essence of Chinese science.

We have seen that there are three different configurations of four mirrors that have significance. There is Shea Zellweger logical computations using mirrors, there is the tetrahedron of inwardly reflecting mirrors that define the octonion, there is the cube of inwardly reflecting mirrors that give us the lifecycle of the Emergent Meta-System. We are brought to wonder by this how many other configurations of mirrors there might be in the magical mirrorhouse (as defined by Onar Aam). What we realize is that within the magical mirrorhouse the mirrors assume different configurations and these configurations of minimal systems of mirrors give us different characteristics from the mirroring. There may be very many of these configurations of intersecting mirrors all with different qualities. Each configuration defines a moment in the interpenetration of Indra's jeweled net.

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