

# Reflexive Autopoietic Systems Theory: A General Theory of Ultra-efficient Special Systems and a new view of the nature of Holonomics

## An Introduction

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Review Copy Only. Unfinished Draft.  
Version 0.04; 8/27/96; IJGS1V06.doc  
First submitted to IJGS 11/01/95

**Keywords:** Systems Theory, Dissipative Systems, Autopoietic Systems, Reflexive Systems, Recursive Systems, Meta-Systems, Ontology, Emergence, Social Theory, Ultra-efficiency, Holonomics

**Summary:** A newly discovered approach to extending General Systems Theory by a set of Special Systems is described. General Systems Theory is distinguished from the theory of Meta-systems. Then a hinge of three special systems is identified between these systems and meta-systems. These special systems are defined by algebraic analogies. Their special properties are explained the most important of which is ultra-efficiency. These three special systems correspond to dissipative, autopoietic, and reflexive systems which are anomalous within general systems theory and provide a bridge between the theory of systems and the theory of recursive meta-systems.

### 1. Systems and Meta-systems

Instead of looking at systems as objects we maintain that they are gestalts<sup>1</sup> and

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1. Köhler, W. [1929] *Gestalt psychology*. H. Liveright, New York.

we do not divide them into sub-systems and sub-sub-systems, but instead contrast the systems view that sees the gestalt with a different way of looking at systems called the meta-system approach<sup>1</sup>. Meta-system is the view of a system that you get when you take it apart and it forms a field of disassembled mutually implicative parts. Or we might say that the Meta-system corresponds to the design landscape out of which the system as a whole arises<sup>2</sup>. Meta-systems have two properties as the background out of which systems arise: They are the *origins* of systems and they are the *arena* within which systems communicate and cooperate or engage in conflict. Many different possible systems might arise from the same design landscape. When certain specific ones are embodied then suddenly the design landscape becomes the arena within which the embodied systems cooperate or conflict and co-evolve. Within this arena systems prove their fitness and those best adapted to the meta-system ecological environment persist longest or at least until there is a catastrophic change in the meta-systemic milieu. These two aspects of the metasystem (origin and arena) provide a general structure in which evolutionary adaptation of complex systems may take place. When the meta-system plays these roles it is switching back and forth between its complementary aspects of origin or arena.

We tend to mix up systems and meta-system views of phenomena because we have no good word<sup>3</sup> for a meta-system other than words like ecology, environment or milieu. However, systems and meta-systems are very different views that can be applied to the same phenomena. Yet, in most disciplines the systematic view predominates and genuinely meta-systemic approaches are exceedingly rare. One notable exception is the discipline of ecology. Taking the meta-system view one sees the phenomena as a field of parts that are implicitly related to each other but disassembled while the other view sees those parts as assembled into a working system. These two views of phenomena and the ability to switch back and forth between them allow us to view things as what Arthur Koestler call “holons.” That is to say, as kinds of entities that have one face facing down within the hierarchy of sub-systems and while having the other face facing upward in that same hierarchy. Holons are two faced like the god Janus always presenting a different face to the whole of which it is a part from the face it presents to the parts for which it is a whole. A holon is defined here as the ability to switch back and forth between the system and meta-systemic views of things. In order to have a sustained holonomic view of things that are nested within super-systems but also contain nested sub-systems it is necessary to find a pivot that allows the observer to continuously change views from macro to micro within the layered super-system. The study of the special systems provides the pivot that exists as a hinge between the system and meta-systems views of things. This study of the meso-level between macro and micro will be called Ho-

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2. A model of such a design landscape could be the NK permutational fitness surfaces presented by Stuart Kauffman in *The Origin of Order and At Home In The Universe*.

3. I would suggest the use of the word ‘Archon’ as a good candidate.

lonomics<sup>1</sup>. Holonomics is the study of the nomos of the holons. Nomos is the intrinsic ordering that exists beyond the dualism of Logos and Physis. Both holons and nomi are nondualistic concepts in contrast to the normal dualistic concepts we use to attempt to dissect systems in our theorizing.

We normally project the Logos/Physis dualism on to things. In this dualism one side usually dominates the other to the point where the dominated side is devaluated. Instead of dualism we support a non-dualistic view which recognizes the inherent trade-off between dualistic extremes which form an interval that contains a point of reversibility between opposites. Holons represent the chiasmic reversibility between the extremes of viewing things as parts or wholes. This recognizes the basic undecidability that exists between our models of phenomena that shows up in the quandary over particle or wave interpretations or in the Hiesenberg uncertainty principle that disallow simultaneous measurement of position and momentum. Holonomics tells us we cannot decide whether something is a part or a whole because it is both simultaneously depending on the context. The inner ordering of things so that they can be nested such that they fulfill simultaneous synergetic roles is the nomos that lies beyond the dichotomy of physis and logos which allows us to recognize partial structures that overlap in the center of the dichotomy. It is possible to construct a model of indeterminate particles<sup>2</sup> that fulfill both the locality and wave like properties simultaneously. To build such a holistic model it is necessary to relax some of our prerequisites of rigor and precision. Hidden variable models of quantum phenomena such as David Boehm's implicate order model are logically consistent as long as we relax our demands for the visibility of all aspects of the system. A similar transition takes place when we relax our need to know definitely whether something is a whole or a part. This generates the system and meta-system views which make holons theoretically visible.

Meta-systems are described very well by George Bataille as "general" or "global" as opposed to "restricted" economies.<sup>3</sup> Arkady Plotnitsky<sup>4</sup> makes the connection between Bataille's idea of a "global economy" and the complementarity that Bohr<sup>5</sup> sees in quantum theories, like in the uncertainty principle. The point is that all meta-systems are intrinsically complementary in contrast to the unification of the classical physical theories that envision systems that can be rigorously consistent and complete simultaneously. Meta-systems preclude having both consistency and completeness at the same time. The relaxation of the rigor of the simultaneous complete-

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1. Jeffrey S. Stamps [1980] *Holonomy : a human systems theory*. Intersystems Publications, Seaside, Calif.

2. ?

3. See George Bataille *Accursed Share*

4. See Arkady Plotnitsky [1994] *Complementarity anti-epistemology after Bohr and Derrida*. Duke University Press, Durham.; [1993] *In The Shadow of Hegel: complementarity, history, and the unconscious*. University of Florida, Gainesville.; [1993] *Reconfigurations: critical theory and general economy*. University of Florida, Gainesville.

5. Dugald Murdoch [1987] *Niels Bohr's philosophy of physics*. Cambridge University Press, New York.

ness and consistency criteria allow us to see the meta-systemic shadow that surrounds every system. Plotnitsky goes on to show that Derrida<sup>1</sup>, following Godel<sup>2</sup>, has concentrated on pointing out the undecidability of classical systems and that this needs to be balanced by pointing out the indistinguishability that interferes with our isolation of the classical unified and monolithic system. Indistinguishability produces the inability to say when a system is complete and undecidability prevents us from showing its consistency. This leads to what Graham Priest<sup>3</sup> calls para-consistency and para-completeness. Para-consistency allows systems to have active contradictions and makes them into meta-systems. Para-completeness allows systems to be incomplete which means they cannot be distinguished from their meta-systemic grounds. Things that are both para-consistent and para-complete are by definition the embodiments of the Other of reason: they are monstrosities that are banned from science. However, our world abounds with undecidable and indistinguishable ambiguities which we have not been able to reduce by the rigors of our disciplines to systematic wholes with the characteristics that we normally attribute to systems<sup>4</sup> which as Rescher says derives from our analogy to the organism.<sup>5</sup>

Once we accept that all systems have meta-systemic shadows of undecidability and indistinguishability, OR complementarily, that all systems originate and interact with other systems in meta-systemic arenas then we see that there is a spectrum that exists from the extreme of pure meta-system to the other extreme of pure system. A system is a gestalt whole that is greater than the sum of its parts. A meta-system has a lack rather than a surplus and is a defective whole that is less than the sum of its parts. Between these two extremes there are stages of assembly of the parts awash in the field of the meta-system until they are fully assembled into the system. When the parts are assembled then the emergent properties arise which give the system a wholeness that is greater than the sum of the parts taken separately. We can posit an idealized transformation which assembles and disassembles these parts. That transformation may work in two directions given any two complementary theories of objects. In other words, a given complementarity may be viewed as either system or meta-system and transformed into its opposite. This means that what looks like a fundamental unity from one perspective can be transformed into a composite. And what looks like a composite may be transformed into a fundamental unity. This characteristic of the complementarity of systems and meta-systems views has been

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1. Derrida, Jacques [1976] *Of grammatology*. Johns Hopkins University Press, Baltimore MD.

2. Godel, Kurt [1940] *The consistency of the axiom of choice and of the generalized continuum-hypothesis with the axioms of set theory*. Princeton University Press, Princeton.; Nagel, E & Newman, J. [1958] *Godel's proof*. New York University Press, New York.

3. ?

4. See Rescher, N. [1979] *Cognitive Systemization*. Rowmann and Littlefield, Totowa, New Jersey. Pages 10-11. Rescher gives the following characteristics of a 'system': wholeness, completeness, self-sufficiency, cohesiveness, consonance, architectural, functional unity, functional regularity, functional simplicity, mutual supportiveness and functional efficacy.

5. See Rescher, N. [1979] Page 12.

dubbed the “duality” property in recent superstring physical “Theories of Everything.”<sup>1</sup> This “duality” property has been found to reduce the many superstring theories to a single theory seen through the fragmentation of its many representations that otherwise appears as many independent theories. We can relate this back to the view that wishes to see systems as hierarchies of sub-systems as long as we realize that the complementarity of systems and meta-systems perspectives is more basic than that hierarchy. When the parts are disassembled we see down the hierarchy of subsystems and when they are assembled we have changed our gaze to look up toward the higher unites of the hierarchy of systems. The intersection of these two perspectives in a single thing converts it into a holon in Koestler’s sense. But due to the complementarity of the two approaches we only glimpse the holon by oscillating between these two approaches. There is not single conceptual framework that captures the holon completely in isolation. Instead we realize that there are a set of anomalous special systems that approximate the point of perfect balance between the two complementary approaches. These special systems that allow us to transition back and forth between system and meta-system views do not form an infinite series, but instead the progression stops after just three steps. Thus our extension of General Systems Theory defines just three holonomic special systems that inhabit the interspace between systems and meta-systems. For general systems theory meta-systems exist in the nether world beyond the limit of understandability defined by the end of the progression of special systems. But meta-systems themselves are infinitely complex and have an indeterminate number of recursive levels of nesting which are also modeled by our mathematical analogies.

General Systems Theory as defined by George Klir in Architecture of Systems Problem Solving<sup>2</sup> identifies a series of epistemological levels by which formal structural systems are defined. These epistemological levels are the object, source, data and generative systems. The levels bifurcate into infinite regresses through the production of meta-structures and meta-processes. Meta-structures allow different patterns within patterns within patterns while the meta-processes control the changes in the structural templates at various meta-process levels in time. Certain chiasmic combinations of Structure and Process are considered by Klir in this epistemological framework as well. We have extended<sup>3</sup> the epistemological framework of Klir to include an autopoietic level and a reflexive learning level beyond the dissipative generative level in his epistemological hierarchy. The reflexive learning level encompasses the meta-levels of learning posited by Bateson in Steps to the Ecology of the Mind<sup>4</sup>. The levels end in the definition of the unthinkable as what occurs be-

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1. Kaku, M. [1994] *Hyperspace : a scientific odyssey through parallel universes, time warps, and the tenth dimension*. Oxford University Press, New York.

2. ?

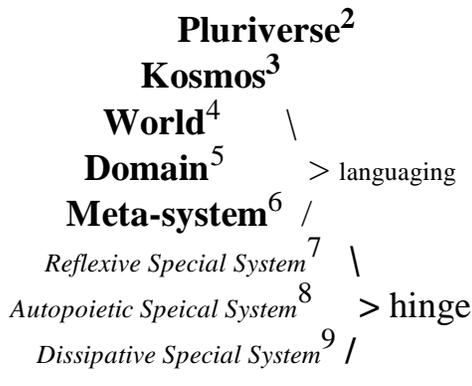
3. See Kent Palmer, “Software Engineering Design Methods and General Systems Theory” *International Journal of General Systems* [Vol 24 (1-2) 1996 pp.43-94].

4. ?

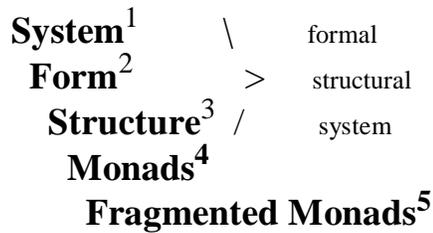
yond the fourth meta-level of learning. Through this extension we first defined three special systems levels associated with the dissipative, autopoietic and reflexive systems. Now we explore the underlying mathematical analogies that support the conceptual definition of the special systems.

What we need to realize is that there are different thresholds of organization to perceptual and conceptual phenomena. We normally concentrate on the forms or outlines of things as the principle level for understanding things. Structural-formal systems posit an organization on the level of content via the positing of a micro formalism such as that we find in Klir's work where data contents are structured in variables. We also sometimes posit the systems level where we see the forms in a supra-formalism which is equivalent to a gestalt. When we combine all three of these ways of looking at things into a single model as Klir does we get a formal-structural system<sup>1</sup> perspective on things. But this series of emergent thresholds of our modeling of things does not have to stop there. We need to recognize beyond that a further series of levels which are called meta-system, domain, world, universe, pluriverse. In this essay we are only concerned with distinguishing the system from the meta-system level and recognizing the special systems that serve as a hinge between them. However, these other emergent ontological levels also play a role in the comprehension of the nestings of the structures of the world.

Figure 1:



1. ?
2. The pluriverse is the same as the manyworlds interpretation in physics. It is the multitude of universes beyond our universe. In Indo-european mythology it was represented by the worldtree Yddrassil.
3. The Kosmos is our universe which is projected upon and differentiated by all other possible universes within the pluriverse. The pluriverse is beyond our kenning but the universe is everything that exists within our kenning.
4. The World is defined by our languaging. As with the Whorfian Hypothesis we believe that different languages create different worlds that highlight different aspects of the Kosmos.
5. The domain is set up by specialized sub-languages under the auspices of a natural language. Thus, the special languages of different disciplines produce different perspectives on the world and create sub-domains within the world. The domain of art, sometimes called the 'art world' is an example.
6. Meta-systems exist between languages and the systems we see in the world. Meta-systems are very nebulous but exist as environments, contexts, situations, mileaus, ecologies, etc.
7. The reflexive special system is the foundation for the social within the world.
8. The autopoietic special system is the foundation for the organism within the world.



Take the example of a software application. We treat the application as a system. But we recognize that we need an operating system to support the resource and computational needs of the application system and to allow different applications to interact. Operating systems are indeed meta-systems that are the origin and arenas for the existence and interaction of application systems. We can see this same distinction when we think of the relation between the Universal Turing Machine and the specific Turing Machine. A Universal Turing Machine<sup>6</sup> contributes the Meta-systemic aspects that allow different Turing Machine embodiments to exist in the same computational environment. Universal Turing Machines are meta-systems within which Turing Machines can be embodied and even interact if one either produces output from one that feeds through the tape to the other or else provides for multi-tasking of Turing Machines within the Universal Turing Machine architecture<sup>7</sup>. From this we can see that not only are meta-systems a familiar phenomena but also we can embody them computationally. Also we can now understand the intrinsic lack that Meta-systems have. Operating systems without applications are useless. Universal Turing Machines without tapes with specific Turing Machines on them are useless. Meta-systems have an inherent lack that is only filled by the provision of systems. Likewise Systems need an arena in which to operate and their environment is just as important to their functioning as their own internal structure. Via the environment they communicate with other systems, garner resources, and interact through mutual actions. The law of requisite variety (Ashby<sup>8</sup>) provides the mutual adequation of the nested systems with a meta-systemic field. The surplus of the gestalt system whole exactly compensates for the lack that exists in the meta-systemic environment. In fact, they need to be fitted to each other like any complementary pair

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9. The dissipative special system is the foundation for the organ, or what Deleuze and Guattari call partial objects (following M. Kline's definition of object relations) or *desiring machines*. *These are the effective constituents of individuals*.

1. Systems are primarily understood as gestalts.

2. Forms are understood in terms of G. Spencer-Brown's Laws of Form.

3. Structures are the subject of Structuralism in the work of Levi-Strauss or Piaget. This is the level beneath of the symbol where the sign flourishes so it is studied in terms of semiotics. Structures are micro-formalisms that organize the distinctions between different kinds of content.

4. Monads are the lowest distinguishable unit of sensation which Husserl called Hyle. It is the content that is distinguished and organized into patterns by structures.

5. Emergent meta-systems theory discovers that monads are fragmented, this is where the many worlds come from is the fragmentation of the monads. Thus we begin to think of monads as summaries over possible worlds.

6. ?

7. Manthey, Michael "Toward an Information Mechanics" IEEE 1994 0-8186-6715-X

8. ?

of things that are made for nesting and to work together. The difference is that in this complementary pairing of system and meta-system the system is a unified whole while the meta-system is itself intrinsically complementary in the sense that Bohr saw in our models of quantum phenomena. In other words in the meta-system there is an exclusive showing and hiding of characteristics that does not occur in the system. The objects are figures that are shown and hidden in the temporal gestalt of the system's dynamism. But the face that we see of the system at each point in the system's evolution exists within the meta-systemic field that has an implicit or implicate dynamism that is only seen in the breaks between systemic regimes in which the objects are reordered or different sets of objects appear. The system has coincident and overlapping characteristics whereas the meta-system has co-exclusive and non-overlapping properties. This difference defines the surplus of one and the lack inherent in the other.

The system and meta-system are complementary ways of looking at any matter. They are inverse duals of each other in the sense that what one has the other lacks. Meta-systems are inherently split into complementary properties like the characteristics related to its role as origin and its role as arena of exchange. Systems on the other hand are apparently unified. But systems within a meta-system may stand in complementary relations to each other. The complement of a system is the anti-system. The anti-system may be embodied or may merely be all the other possible systems, other than a particular system, within the meta-system. If there is a specific anti-system then all the other possible systems become classified as the non-system. The Greimas square allows us to construct the anti-non-system which holds the position of the Other with respect to the system. We may construct a chiasmic relation by reversing the anti-nonsystem and getting the non-anti-system. This chiasmic reversal within the Other is our access to non-duality. This chiasm is mirrored in the complementarity of the meta-system in the relation of origin to arena. In other words the Otherness that appears to us arising out of the meta-system is inherently split into a chiasmic reversal where either the anti or the non is emphasized. If the anti is emphasized we see the arena within which the system confronts its opposites. If the non is emphasized we see the variety that is being produced and our attention is focused on the origin of that variety. The meta-system is the nexus out of which Otherness arises and is sustained from the viewpoint of the system. That Otherness drives its need for requisite variety, But variety is not random difference. Variety arises together from the source of the meta-system and plays itself out within the arena of freedoms set up by the meta-system. This play unfolds the necessary dimensions of Otherness directly expressing the needs of the system for opposite variety to its own internal coherence of differences. The complementarity of system and meta-system conditions and grounds all other complementarities between systems and their Others that take place within the meta-system and causes the complementarity of the meta-system to manifest.

Once we have understood the distinction between the System and Meta-system as the difference between a whole greater than the sum of its parts (a surplus) and a complementary assemblage less than the sum of its parts (a lack), then it is possible to consider the special systems that appear as a hinge<sup>1</sup> between these two ways of looking at things. Unless we recognize the complementarity of the system and the meta-system and the complementarity within the meta-system then it is impossible to ‘see’ the special systems that arise between them. This is because we are used to seeing everything as systems and we reserve the meta-system as subsidiary concept rather than as a way of approaching things that is co-equal with the approach to things as systems. When we see surpluses (of projected gestalt systems) everywhere and suppress the complementarity of things it is difficult to realize that anomalous special systems exist that exactly balance these two complementary perspectives. However, there does exist when we look at things in the right light a set of special systems that exactly balance the concerns of the system and the meta-system and in the process produces some very special emergent properties that seem anomalous from the perspective of either systems or meta-systems. These special systems, or partial meta-systems, are exactly equal to the sum of their parts with no excess or deficiency. There are exactly three such special systems that can be called by the names dissipative, autopoietic and reflexive special systems. Each one has its own emergent properties different from the properties of Systems gestalts or Meta-system proto-gestalts. We follow David Bohm<sup>2</sup> in ascribing implicate order to meta-systems and we call them proto-gestalts to distinguish them from normal gestalts that underlie systems. Proto-gestalts generate the discontinuous changes that occur in gestalt fields. These produce temporal gestalt formations in which a gestalt is associated with a duration which suddenly changes into a completely different gestalt pattern. Proto-gestalts produce the pattern of discontinuities that fragments gestalts in time. In this way proto-gestalts are similar to process meta-models in Klir’s ASPS<sup>3</sup> while gestalts are similar to meta-structures. The difference is that process and structural meta-levels are both visible modulations of data by generative functions, whereas proto-gestalts are invisible operating behind the scenes to produce emergent events in which genuinely new process and structural patterns are generated. Proto-gestalts contain the pattern of emergent novelty implicit in a series of gestalt system formations.

The dissipative system has been best described by Pirgogne<sup>4</sup> and demonstrated to be a special phenomena by the exploration of far from equilibrium thermodynamic processes. These dissipative phenomena are seen to be neg-entropic local fluctuations that make possible the arising of life and other complex ordered phenomena.

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1. See Jacques Derrida *Of Grammatology*
  2. See David Bohm *Wholeness and the Implicate Order*
  3. *Architecture for Systems Problem Solving*
  4. ?

The autopoietic system has been best defined by Maturana<sup>1</sup> and Varela<sup>2</sup> who use self-organization as definition for life. The best introduction to this literature is John Mingers' Self-producing Systems<sup>3</sup>. An autopoietic system is seen to be closed maintaining its own organization as a homeostatic variable. It is composed of a network of nodes that produce their own structural components which are then organized by the system to produce itself.

The reflexive system is posited as the social extension of the autopoietic system. It is best defined by John O'Malley in The Sociology of Meaning<sup>4</sup> and by other reflexive theorists from the Sociological tradition that looks at the philosophical roots of sociological theory. A good introduction to this literature is Ashcroft's The Reflexive Thesis<sup>5</sup> and Alan Blum's Theorizing<sup>6</sup>.

Autopoietic theory has been variously applied to social groups by different theorists<sup>7</sup>. The authors of this theory deny that it is a valid use of the theory and distinguish between autonomous and autopoietic systems. They see social groups as one form of autonomous system that is made up of autopoietic systems, but they stress that social systems have different properties than merely living systems. This difference can be defined by saying that reflexive social systems are heterodynamic instead of homeostatic. This means that social systems are continuously changing with radical changes that transform their essence. In the process of accepting these radical changes the social system is ecstatic, or as Heidegger says ex-static, which means it is continually projecting itself outside of itself into the others of the society of which it belongs. This many to many self projection of the social organism that G.H. Mead called the "Generalized Other"<sup>8</sup> can be seen as having the nature of a meta-hologram in which the perspectives of the social group are holographic as well as the contents of the parts. And this meta-hologram contains a myriad of sub-holograms that all interpenetrate each other. George Leonard has called this meta-hologram the "holoid."<sup>9</sup> In the meta-hologram<sup>10</sup> each member is the whole which is mirrored in all the other parts. All the perspectives on these various wholes are contained within the meta-hologram in such a way that all the perspectives contain parts of all the other perspectives. We can use Aczel's<sup>11</sup> model of Hyper-sets which are

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  2. ?
  3. ?
  4. ?
  5. ?
  6. ?
  7. ?
  8. ?
  9. See G. Leonard *The Silent Pulse*
  10. Onar Aam has called this mutual mirroring structure the magical mirrorhouse on the analogy of the fun houses that have mirrors in circuses.
  11. ?

Non-well-founded and violate Russell's dictum that sets do not contain themselves<sup>1</sup>. The meta-hologram is a model of interpenetration in which the tremendous overdetermined synergy that exists in the social arena is modeled. We can follow Arkady Plotnitsky in saying that these perspectives and sub-holograms within the meta-hologram are "heterogenously interactive and interactively heterogeneous." We can go further and call the meta-holographic structure a projection of the world. Each projected perspective within the world we would call a domain. Normally the domains are embodied by a living linguistic sub-culture. The projected world encompasses all the linguistic subcultures within a single overarching synergetic unity. Within those linguistic sub-cultures we can produce either complementary theories of phenomena described by meta-systems or monolithic classical theories of phenomena that we describe as formal-structural systems.

In order to understand the context of this theory it is necessary to say something about the Kosmic Atom (monad) / Pluriverse - Fragmented Monad. We notice that the ends of the ontological emergent hierarchy are bounded by the Kosmos and Pluriverse at one end and the Monad and the Fragments of the Monad at the other end. We can construct a picture of the totality of all things by considering the Kosmic Atom and the Pluriverse of Fragmented Monads. The Kosmic Atom is a standard symbol in Theosophy standing for the archetype of what exists on the edge of form where it bleeds off into formlessness. There are many representations of Kosmic Atoms within the western mystical literature. The basic concept is that each atom of the subtle universe has the same form as the whole universe so that everything is produced from a single archetype of energy involution. The normal form of the Kosmic Atom is some kind of helix structure that turns back in on itself like the worm Omenborus eating its tail. The theosophical Kosmic Atom is merely a picture of the paradoxicality of the Totality of what Is. It is very similar to the paradoxicality of the autopoietic system as defined by the biologists Maturana and Verela. Hofstader dealt with many similar paradoxical formations in Godel, Escher, Bach: Eternal Golden Braid. We see images of this archetype in the Chinese Dragons that hover between form and formlessness. The Pluriverse and the Fragmented Monads (atoms), on the other hand, is the inverse of the Kosmic Atom archetype. The Pluriverse of Fragmented Atoms is like the meta-system to the Kosmic Atom system. In the Pluriverse there are many possible worlds that are simultaneously present. These many possible worlds interfere with each other to produce what we know as the real world. These worlds are constantly arising and canceling and in fact act like a swarm of monads from the theory of Self-Generating Systems. These monads fragment and it is that fragmentation that produces the many worlds. In other words instead of positing many possible universes we can equally posit fragmenting monads in which the worldlines of these fragmenting monads diverge. What we notice is that the distinction between the System and Meta-system is writ large in the relation between the

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Kosmic Atom and its umbra of Many Possible Worlds that are produced by the Fragmentation of Monads. The Kosmic Atom is the result of the cancellation of the Possible Universes that hover around it. Similarly we can see that at the next level down there is a World Structure that serves as the meta-system to the Formal Domain. In other words, the distinction between system and meta-system reverberates in these higher and lower levels of ontological emergence. In order to see this all we must do is combine the concepts that are opposite each other at the two ends of the spectrum. So we see why this distinction between System and Meta-system is so crucial. The reason is that it underpins the hierarchy of ontological emergent levels by which we comprehend phenomena. At the highest level we model the highest archetype of the interface between form and formlessness. The Emergent Meta-system formation is an explicit process model of the Kosmic Atom. But we realize that our kosmos is merely one of many possible universes and that these universes cancel out leaving our universe in exactly the same way as cancellations occur within the Emergent Meta-system. So the spacetime within which the Emergent Meta-system operates is produced by the same process as the Emergent Meta-system itself. But that process is seen as the Pluriverse of Fragmented Monads instead of as a swarm of Monads. Similarly, The Domain of Form which Science takes to be its object must be subjected to the critical accounting of the World Structure. The World Structure has been explored by Husserl in Krisis and by Schutz in his Sociological explorations of the concept of lifeworld. Phenomenology discovers the structuring of the world that acts as a meta-system for all formal domains. Science is blind to its own roots in the lifeworld. Heidegger attempted to lay out this world-structuring in Being and Time in terms of being-in-the-world or *dasein*. What we see of interest is that Physics when it explores its limits formulates the concept of the Pluriverse but it is only theosophy that formulates the paradoxical Kosmic Atom that is the focus of the Pluriverse. Phenomenology, Dialectics, Hermeneutics and Structuralism explore the World Structure beyond the realm that Science will allow itself to enter, rather it restricts itself to the formal domain. Thus Physics attempts to stick within its formal domain but ends up escaping into the strange domain of the Pluriverse. On the other hand the Humanities formulates the process of world structuring that goes beyond the formal domain and encounters paradoxes that it formulates in terms of the Kosmic Atom which are similar to the paradoxes formulated by the theosophists that go beyond what even social scientists are willing to entertain. But this whole formation that arises when we consider the fact that the ontological emergent hierarchy folds back into itself is merely a ramification of the basic distinction between systems and meta-systems taken on a grand scale. We can learn the most about this distinction if we stick to the relation between systems theory and its meta-theory. But it is good to be aware that this distinction has many ramifications within our tradition that could be explored in order to amplify on what is said here.

The important point about these special systems is that they are defined not just by theoretical definitions, but more succinctly and rigorously by mathematical

analogies. Each threshold of complexity that defines a special system level is associated with a particular algebra. These algebras form a natural series that define the minimal emergent properties at each transition point between special systems. The fact that we can find a mathematical basis for our theory of special systems is quite unexpected, but if proven sound it opens the possibility of the long sought after mathematical basis for the social and psychological sciences. At the reflexive threshold of complexity we find an intrinsic sociality that we can construe as the relations between individuals or as the relations between cognitive agents in the “society of the mind” ala Minsky<sup>1</sup>. Since the layers of progressive emergence begins with normal systems and then defines neg-entropic far from equilibrium natural systems and then specializes further to give autopoietic living/cognitive systems before finally further specializing to give us social/psychological reflexive systems. There is a nice progression that naturally leads to the definition of the socius as a *sui generis* phenomena. This series of emergent levels abruptly stops at this final social level before giving way to the pure recursive meta-system of infinitely deep complexity. This shows us the intrinsic connection of the social to previous emergent phenomenal levels as well as giving us a glimpse of the preeminence of the social as the final strata of phenomenal emergence from which we gain a vista on the panoply of the manifestations of the pluriverse. We can use this final level of phenomenal emergence as the foundation made clear by our mathematical analogies as the basis for a new Social Phenomenology. Social Phenomenology takes the social as the bedrock of all phenomenal experience. In that we follow Durkehim who posited that the philosophical categories were in fact socially constructed. But we build upon the work of modern philosophers who posit the socius not the individual as the most basic unity upon which our world is built. So social phenomenology now has a rigorous mathematically derived foundation that we can exploit to build a more “scientific” sociology and psychology.

This way of defining the special systems by recourse to mathematical analogies leads us to redefine general systems theory on the basis of order instead of the things being ordered. Normally we say a system is a set of components and relations between these components. The relations between components form an  $N^2$  static structure, but where the components interact then the result of the dynamics are different qualitative regimes. Those qualitative regimes may be seen to reflect the interpenetration of the interacting components. As we know from chemistry the qualities of combined components may be very non-intuitive so ultimately we have to try each interactive relation between components in order to discover its specific qualities that may be very surprising. Interactive interrelations are the external manifestation of internal interpenetration of the components. The interpenetration only occurs because the things that are interrelated dynamically are empty. So there is a dialectic between something and nothing that gives rise to the layering and multiplicity that

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underlies the emergent patterns we see in our world. We normally do not mention that to resolve paradoxes that arise in dynamic interaction we will have to appeal to ramified logical type theory so that there are meta-levels of things within the system and there are different types of things at each meta-level. Also it is normally not mentioned that we need to leave room for the existence of nothing (like zero) within our definition of the system (i.e. the place holder of something). These different ways of defining the system based on its relations and the things woven together by those relations leads us to a definition similar to that posited by G. Spencer-Brown<sup>1</sup>. Spencer-Brown stops his elaboration of this formalism at the point where time would be introduced into it -- that is at the point where the formalism would have to become structural. The formalism as a whole defines a system in the classic sense as the set of all formulas that can be derived from the two axioms of form.

Figure 2:

$$()() = ()$$

$$(() = \text{“nothing”}$$

These formulas assume the primitives:

Figure 3:

- Something
- Nothing
- Multiplicity
- Hierarchy

These in turn become the fundamental constituents of forms. When we look at these constituents we see that hierarchy and multiplicity play off of each other either in the realm of something or in the inverted realm of nothing. We can see that the layering and multiplicity of Nothing is equivalent to the ramified higher logical types of Russell as described by Copi<sup>2</sup>. Thus there is produced a framework of manifestation where meta-level layering and multiplicity within which something or nothing appears is prior to the establishment of relations or operations for the elements. It is through this framework that the basic constituents of form are laid out in relation to each other before explicit relations are created between things.

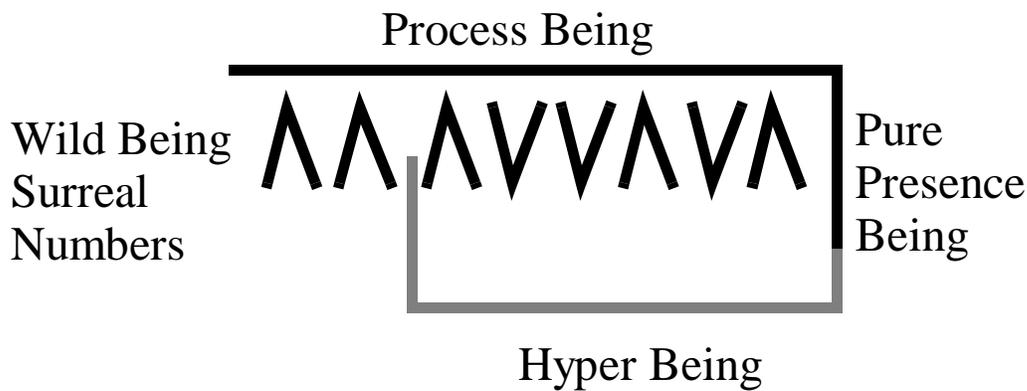
At this point it is necessary to introduce the concepts of the Kinds of Being<sup>3</sup>.

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1. See G. Spencer-Brown *Laws of Form*  
 2. See Copi, I. *Higher Logical Types*  
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We will do this using G. Spencer-Brown's Laws of Form<sup>1</sup> and John Conway's Surreal Numbers<sup>2</sup>. If you follow Laws of Form closely one will notice that each aspect of the formal *Mark* refers to a different kind of presentation, that is a different kind of showing and hiding, and since Being, or Manifestation, is only showing and hiding this means that we have introduced at least four different kinds of Being instead of the normal unified kindless Being of traditional philosophy. It has been in the last hundred years that the kindness of Being has been discovered and explicated by modern Continental philosophy starting with Husserl and moving forward into the other dimensions of Being through the work of Heidegger<sup>3</sup>, Sartre<sup>4</sup>, Merleau-Ponty<sup>5</sup>, Derrida<sup>6</sup>, Deleuze<sup>7</sup> and others<sup>8</sup>. In order to make the explication of these kinds of showing and hiding brief we will use the Mark and say that the following correspondences hold.

FIGURE 4 Laws of Form and Surreal Numbers



The vertical stem of the mark indicates the point of the now within the process that is indicated by the overhanging horizontal roof of the mark. The dotted line indicates the jumps that Spencer-Brown adds to the formalism later in the book which generates the proto-imaginary numbers that he refers to.<sup>9</sup> These jumps introduce non-linearity into the formulas of the laws of form arithmetic and algebra. Varela and

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Kaufmann introduce the idea of oscillating wave forms within the formalism.<sup>1</sup> When this process oriented interpretation is imposed then the Hyper Being loops are the points where the nestings of the formulas involute. Now if we accept this deeper reading of the Laws of Form as being more than just a formalism that achieves non-duality of operator and operand but goes on to indicate different kinds of presentation. For instance, there is the momentary presence of the vertical stem, there is the temporal duration of the overhanging horizontal roof, and there is the discontinuous motion of the jumps. Each is a kind of temporal presencing. Each kind of Being indicates a different form of persistence within manifestation which has been revisited many times in modern Continental philosophy. But this scheme leaves out one of the canonical kinds of Being. We can capture this last form of Being which is called Wild Being by imagining the Forms of the Laws of Form as being filled with Surreal Numbers as discovered by John Conway and popularized by Donald Knuth. These numbers are formed by a progressive bisection starting from zero. There are two symbols called up and down. These are progressively permuted to form a tree structure the nodes of which are mapped to the numbers. What is interesting about Surreal numbers is that it is possible to derive most of the properties of other more familiar numbers from them. They include all the infinite and infinitesimal numbers as well as the Reals, Rationals, Integers and Naturals. If we see surreal numbers as the content of the laws of form then we find that surreal numbers perfectly express the nature of Wild Being within the context of the other kinds of Being represented by the Laws of Form. To be more exact, just as the Laws of Form goes beyond the duality of operator and operand, so the surreal numbers go beyond the duality of quality and quantity. The relation between quality and quantity is contained in the formula  $N^2$  and  $2^N$ .  $N^2$  is the number of things in a system and all their relations. On the other hand  $2^N$  are the number of interpenetrations of those  $N$  things which define the possible qualities of the dynamical system operating within the meta-system. The surreal progressive bisection can either map to numbers or even more naturally represent the  $2^N$  interpenetrations of things in a system and thus it's possible qualities. Both the Laws of Form and Surreal Numbers add crucial characteristics to the four aspects that underlie the Laws of Form and its complement the laws of Pattern: namely *something*, *nothing*, *layering* and *multiplicity*. Out of the multiplicity comes the ability to have multiple things in a system that can be related or interpenetrate to form quantitative and qualitative characteristics of the system. On the other hand out of layering comes the possibility of the progressive bisection tree which gives us the qualitative and quantitative contents of the formal system that surrounds and imbues things with their Quantifiers and Qualities. Operations are actions performed on the things or if the things are verbs then they meld into the Operators and other things become nouns. This allows us to have dynamic relations between things. Those dynamic relations may be transformations. The arising of quality and quantity and the ability to transform things with respect to their qualities or quantities gives

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us the fundamental basis of the formal structural system like the ASPS of Klir. As the special systems unfold from the General Formal Structural System that we see in Klir's epistemological hierarchy we will see the arising of special meta-operators first introduced by Goertzel as part of his formulation of the "Magician" Self-generating Systems (SGS). Those special meta-operators are creation, annihilation, mutual action and gestalt pattern formation. These arise as the inverse dual to the Formal Structural System as explained in a previous paper by the author in the IJGS journal<sup>1</sup>.

The four aspects underlying the laws of form/pattern when combined with the four meta-operators give us the definition of the Emergent Meta-System (EMS) which is the inverse dual of General Systems Theory. In Emergent Meta-Systems there is a pure theory of meta-systems that is founded on discontinuity rather than the underlying assumption of continuity that systems theory makes. Emergent Meta-Systems assume radical spatial and temporal discontinuity and then attempt to explain the apparent continuities of the swarming components of the meta-system. This age old problematic that haunts Buddhist Metaphysics is finally solved by the realization that the Emergent Meta-system is engaged in recursive reflexive mirroring. This the life-cycle of the EMS has four moments in which the reflection travels around the inwardly mirrored cube of separate life-cycle stages. In the EMS formation there is no movement but only recursive reflexion in which the different life-cycle phases mirror each other in precisely the way that Heidegger describes in the mutual mirroring of the positive fourfold of Heaven, Earth, Mortals and Immortals in his later philosophy. In the EMS structure the components of each phase are qualitatively different so that the monads of the swarm reflect into the candidates in the slate that reflect into the seeds in a pod that reflects into viewpoints in a constellation that finally reflect back into monads in a swarm. This recursive reflexion is done by the application of the meta-operators one by one to particular reflexive modes of the EMS. This gives us a formal mode of meta-systemic operation which implicitly allows us to derive the EMS from the unfolding special systems because as each meta-operator arises properties are lost at each stage of algebraic unfolding.

The EMS structure is a model of the kosmic-atom which is the archetype for the transition from form to formlessness in many philosophical traditions. Plato calls it the Spindle in the *Timaeus* and the Chinese call it dragons in their tradition. The dynamical unfolding of the Kosmic-atom is seen as the pluriverse that is created by the fragmentation of monadic observers. Thus there is an oscillation between unity and multiplicity at the macro and micro levels that frames the meso level, the special systems, and the formal structural system levels of the ontological emergent hierarchy. This oscillation may be seen as the involution of the kosmic-atom into otherness and back out again and concretely this involution has the form of the recursive reflection of the EMS structure because these are the complementary aspects of the ul-

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1. IJGS vol24 (1-2) 1996 pp 43-94

imate meta-systemic formation.

When we accept surreal numbers as the content for the Laws of Form we suddenly have a complete structural picture of the interrelations of the different kinds of Being. A similar picture can be gotten by realizing that each of the different kinds of Being relates to different kinds of Mathematics also:

*Figure 5:*

Pure Presence Being = Calculus

Process Being = Probabilities

Hyper Being = Fuzzy Numbers or Possibilities

Wild Being = Mathematical Chaos or Propensities

These four kinds of mathematics fit together as an example of how the different kinds of Being form a synergy. We can see a similar but differently broken symmetry in the fitting together of the Laws of Form and the Surreal Numbers. These synergies allow us to envisage how the different kinds of Being interoperate. Another example of such a synergy is the coming into Being and mutual annihilation of virtual particles. Each synergy teaches us something about the integrity of our worlding of the world. I have explained these various synergies in several of my working papers. So I will not burden the reader with a complete explanation here. Suffice it to say that when we place the surreal numbers in the laws of form we get a complete picture of the synergetic integration of our worldview and there are other similar formations in different domains.

However, I would like to mention a very important consequence of this formulation of the “surreal laws of form.” Surreal numbers contain infinitesimals and infinities. We can see these as positive feedback loops that produce infinite variety on either side of the decimal point. Surreal numbers also have holes that separate the infinities/infinitesimal from the other numbers within the surreal meta-number system. If we think of the infinities and infinitesimal as very deep peaks and valleys in a tree-like landscape then we can think of connecting them together randomly to get a multiply connected landscape where the valleys connect to valleys and peaks connect to peaks. Or we might even think of the peaks connecting to valleys as the landscape twists around itself. Similarly we can think of the holes in this landscape connecting to other holes to give us wormholes through the fabric of the landscape. But what about the possible connection of holes to peaks or valleys. This possibility actually defines the dissipative system within the multiply connected and wormholed surrealistic landscape. In such a connection there would be the sudden emergence of infinite information from a hole or ‘nowhere’. This is what Stuart Kaufmann calls ‘spontaneous generation of order for free.’<sup>1</sup> It is the emergence from the void of in-

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finite information just like occurs in a strange attractor. Only here there is no cycling but only the outpouring of information from a singularity which is the hallmark of the dissipative system that is far from equilibrium but can indefinitely sustain that off-balance poise that appears as negative-entropy. Once we have a model of the dissipative system it is only a matter of conjuncting such systems together to form an autopoietic system and conjuncting them into minimal systems of four dissipative systems to create a reflexive system. So we now see how there arises out of the surreal numbers the possibility of the special systems hierarchy from with the multiply connected fabric of quality/quantity non-duality. That quality/quantity non-duality exists within another non-duality that connects operator and operands in terms of the Laws of Form. The Laws of Form and Pattern (the dual of the Laws of Form) provides the cup that holds the wine of Wild Being. That cup is made up of the three other kinds of Being melded together.

I will try to explain this in the following way. Plato said in The Sophist<sup>1</sup> that there is a hierarchy of the initiated. The uninitiated are the ‘men of earth’ that only believe what is in their hands. Those initiated into the lesser mysteries believe in the Unseen but think that it is all flux, like Heraclitus.<sup>2</sup> Those initiated into the greater mysteries believe in the unseen but believe it is all static, like Parmenides.<sup>3</sup> This hierarchy leaves out the hierophant who distinguishes the seen and unseen and also distinguishes dynamic and static but who knows what we really want is ‘change and changelessness at the same time,’ i.e. non-duality. Now those initiated into the greater mysteries are those that recognize Being as Static like Plato, Aristotle, Descartes, Kant and Husserl which is the meaning of Pure Presence kind of Being. Those initiated into the lesser mysteries are those that recognize Being as a dynamic process of manifestation like Heidegger or Sartre for whom Nothingness has similar yet opposite characteristics. He constructed out of the two lowest kinds of Being an Ontological Monism<sup>4</sup> in which the static and dynamic kinds of Being formed a reciprocal closed loop. Michel Henry in The Essence of Manifestation<sup>5</sup> noted this primary assumption of Heidegger’s that there was an ontological monad composed of the two different kinds of Being he recognized. Henry suggested the alternative of Ontological Dualism and posited that there was an Essence of Manifestation that was purely immanent and was never seen. This was the Unconscious, or as Meister Eckhart called it ‘a cloud of unknowing’ within not consciousness but the more general realm of manifestation. Henry said that there was some part of Being that never appeared in manifestation and called that the essence of manifestation. Later Heidegger recognized this realm as ~~Being~~ (crossed out) in his essay on Junger called ‘On the Line.’<sup>6</sup>

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Derrida picked up on this kind of Being and called it DifferAnce in Of Grammatology<sup>1</sup>. Merleau-Ponty called it the Hyper-dialectic in The Visible and the Invisible<sup>2</sup> of Process Being and Sartre's Nothingness<sup>3</sup>. Levinas called it the realm Beyond Being<sup>4</sup> where ethics and metaphysics merge in the bearing of the ministrations of the Other. There have been many formulations of Hyper Being in Continental philosophy and it's discovery by Heidegger and Henry has left a profound impression on modern metaphysics. This is a non-dual realm beyond the static and dynamic where, as Derrida says, there occurs a differing and deferring. This is where the Hierophant's perception of Manifestation flows from. But there is a matter beyond this non-duality such as that which appears in Surreal Numbers between quality and quantity and in the Laws of Form and Pattern between operators and operands. This is the matter of Wild Being. In Hyper Being the discontinuities within the continuums of manifestation are discovered to be the source of the continuums. But in Wild Being we go beyond this to realize that there is not difference between the continuity and discontinuity or between order and disorder. This is the realm where Chaos in the mathematical sense appears that is an odd mixture of order and disorder or continuity and discontinuity. In this realm one realizes that there is ultimately no difference between the Essence of Manifestation that never appears and what does appear. They are duals of each other so appearance continually points to that which never appears. Appearance taken as a whole is a complementary and distorted picture of what never appears. At the level of the writer of the sophist dialogue in which the hierophant is played by the wise sophist, i.e. at the level of Plato himself, the dialogue writer, there is the blending of the hierophant's knowledge of the unconscious with that of the initiated and the uninitiated. Plato demonstrates all the levels of Being to us and his comprehension of them in the action of his writing that performs what he thinks which is the synergy of manifestation. These synergies are the source forms. Plato saw the source forms as strange attractors within which manifestation unfolds around the synergies, such as we have been describing in which the four different kinds of Being, and participate together to form a nexus within manifestation of the different kinds of presentation.

In Wild Being there is a synoptic vision of the whole of manifestation in all its different kinds as they fold through one another endlessly. One picture of that is the creation and destruction of virtual particles. Such particles can act on other particles and can be seen together as a kind of dualistic gestalt and so right here we have a picture of the meta-system on the par with that created by Goertzel in his model of the Self-Generating 'Magician' System which is the inverted dual of the general system such as that built by Klir. All systems exist within meta-systemic milieus. Thus the conserved particles are the system that exists within the milieu of the virtual par-

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ticles that supply their field like properties. Similarly we can talk loosely about the different kinds of mathematics as avatars for the different kinds of Being. Calculus gives us determinate continuous functions and the duality between the Integral and Differential. Probabilities on the other hand depend on actualities and have inherent error with mean and standard deviation as well as higher meta-level deviances. Probabilities are needed to describe actually observed phenomena whereas calculus describes determinate idealizations. But eventually we are led to formulate the Fuzzy numbers which embody possibilities instead of probabilities. These do not sum to one as probabilities must to mimic actualization of possibilities in concrete existing phenomena. It is these possibilities that give us an analogy for Hyper Being because there are absolute differences between possibilities. These absolute differences are the discontinuities lording over the continuities rather than the reverse that occurs in calculus. Probability is a half way house between continuity and discontinuity that emphasizes the individual existent thing regardless of continuity or discontinuity. The individual instants can be seen as part of a normal curve of frequencies but there is always the discontinuities between individual cases. When Wild Being arises the continuity and discontinuity gets chaotically mixed. Here we have chaotic propensities that link the possibilities to the actualities with the addition of a tendency that throws the possibility toward a particular actualization. Deleuze and Guattari call this a line of flight in *Anti-Oedipus*<sup>1</sup>. We know that the combination of a possibility and a probability is called a hyper-number according to Kauffman<sup>2</sup>. To get a propensity all we need to do is multiply the two parts of the hyper-number. This gives us our propensity for the actualization of a possibility with a certain probability. Wild Being is composed of a field of propensities or tendencies. Coutu called this field the “tendency in situation,” or TINSIT, and said that this was the primal unit of the social system<sup>3</sup>. We agree with his analysis, but situate it in relation to the other forms of measure and calculation. The field of propensities<sup>4</sup> is precisely what the social fabric is composed of and it arises as the distortion in the reflexive action at the level of the octonion algebras. This distortion arises due to the non-associative and non-commutative nature of the octonion algebras. The distortion is what arises first -- then there appears that which is distorted! We see the traces of the things in the distortion pattern and reconstruct the things just as we stare at the field of distorted images and see the three dimensional images embedded in the randomized field. The multiple traces of the distortion allow us to triangulate back to what left those traces. Thus we see the essence of manifestation that never appears within the distortions in the field of appearance. In that realization we realize the non-duality of continuity/discontinuity and order/disorder. That secondary non-duality points us back to the primary non-duality of the complete meta-system that lies just beyond the reach of the special sys-

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  2. *The Origins of Order*
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  4. *The Propensities of Things*

tems. In the meta-system there is absolute complementarity that we can only understand in terms of anti-epistemology and beyond that anti-ontology. This complementarity points always to the underlying non-duality of things thorough the continual arraying of complementarities of complementarities. This is what Plotnitsky calls ‘heterogeneous interactivity and interactive heterogeneity’<sup>1</sup> and what Deleuze and Guattari call the rhizome.<sup>2</sup>

Another way of defining a formal structural system is in terms of the appearance of kinds of order. Klir hints at this possibility in the section of ASPS where he talks about methodological distinctions.<sup>3</sup> He gives us a lattice of the different kinds of order that a variable can take on in its sequence of values. These form a lattice that has its root in unordered distinction which gives rise to partial ordering and then fans out to encompass both linear order without distance and partial order with distance before merging again at the point where full order that is linear and with distance appears. We can see a system as coming into being by accruing different degrees of order in its variables. We can recognize that some variables may be prevented from achieving full ordering. But the system arises as it attempts to attain full ordering in all its variables. We have shown that differential ordering effects the design of real-time computer systems due to the fact that certain background variables by which other system variables are measured cannot achieve anything higher than partial ordering.<sup>4</sup>

If we think of systems as sets of variables that emerge by progressive ordering and that some variables get stuck at various stages of ordering, then we only have to continue this progression beyond the emergence of the illusory continuity of the real numbers by allowing the conjunction of variables to form complexnion, quaternion, and octonion formations. This conjunction of variables that otherwise might be viewed as real produces some very strange properties in the conjuncted system that both relativity theory and quantum mechanics take advantage of to describe the strange properties of physical systems. In fact, we could follow Pirgogine and refer to the set of uncertainties that he associates with thermodynamics, relativity theory, and quantum mechanics.<sup>5</sup> But however useful these hyper-complex algebras of supra-ordered variables may be to physics their significance for systems theory has never been explored previously. When we view the systems as the progressive ordering of their variables then when we go past the reals we naturally move into the conjunction of these variables into hyper complex algebras. These algebras are the natural set of relations between these variables which exhibit no surpluses nor lack. In fact, because they manifest neither surplus nor lack they indicate directly the such-

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2. *Thousand Plateaus*  
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ness of existence beyond showing and hiding relations of manifestation.

In a previous article I have shown that the “Magician”<sup>1</sup> meta-systems (a special case of self-generating systems) are the dual of general systems of the type defined by Klir. This duality is difficult for us to think about because we are not used to thinking about meta-systems. And to think the duality between systems and meta-systems is even more difficult. But a simple way to explain this functor is to say that systems assume continuity of the gestalt object. Goertzel has attempted to define formalisms that do not assume continuity but instead make the counter assumption of discontinuity. In a magician system you must show how continuity is achieved instead of trying to explain discontinuity as we do in normal systems theory. A magician meta-system is a swarm that persists in spite of fundamental discontinuity. It does not form a system because there is no lasting gestalt. Instead we have a model of the proto-gestalt’s implicate order manifesting over and over again in the patterning of the swarm. This is more a mosaic or collage in which mutually self-generating elements create and destroy each other rather than a single gestalt. The meta-pattern is expressed in terms of mutual action and gestalt pattern recognition and generation between the magicians of the SGS. Gestalts arise within the context of this discontinuously changing manifestation. As such the Gestalts are systems within the milieu of the Proto-Gestalt meta-system made up of swarming self-generating elements. The magician meta-systems form the substrate upon which systems are seen as figures on the ground of continual the arising of virtual system and anti-system pairs that annihilate each other in a continuous chaotic morass that underlies the manifestation of all forms and patterns. The opposite of form is chaos, but as we have learned recently chaos is not the lack of all order but instead the mixture of order and disorder. That mixture, as it manifests to us, has a kind of Wild Being. It is shot through and through with discontinuities of every kind which lends it a sort of Hyper Being. So that the frozen continuity of forms and the dynamic continuity of Systems signified by Pure Presence kind of Being and Process kind of Being that supports systems gestalts finds its opposite between the manifestations of these two strange kinds of Being (Hyper and Wild). Magician systems arise out of the gap between these kinds of Being as the dual of systems that are supported by the more normal kinds of Persistence and Flux that were first defined by Parmenides and Heraclitus that we understand from the history of metaphysics and upon which we implicitly build the ontologies that underlie our systems theory. When we understand the mosaics and collages that are the inverse of our systems then we are able to understand that magician formalisms are not only possible but a necessary part of comprehension of systems from the point of view of meta-systems.

Now consider Peirce’s categorization of predicates into Firsts, Seconds, and Thirds. Firsts are the things that appear, nothing more nor less than their appearanc-

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es. Seconds are the relations between the Firsts. And Thirds are sets of relations that approach the limit of continuity. To these we add another category called Fourths which are synergetically overdeterminations of Firsts, Seconds, or Thirds. Fourths we take from the work of Buckminster Fuller<sup>1</sup> who studied synergies in Geometry. Peirce denied the existence of Fourths, but he only dealt with logic not geometry. Logic can be exhaustively described by the first three categories but geometry needs the additional category of synergy to be understood. Points, lines and planes are re-used in higher dimensional forms in an overdetermined way to form synergies that go beyond what can be described by these first three categories and necessitate the introduction of the Fourth.

Now when we look at the lattice of the kinds of order we notice that the first kind of order defines Firsts alone. But that the other kinds of order describe the different kinds of relations that can appear between things. So the whole lattice describes the kinds of Seconds that can distinguish and connect Firsts. So we can see our system coming into existence first as orthogonal distinguished Firsts (something) which then develop Secondary relations between themselves of the different kinds of order that appear in the lattice of Methodological Distinctions. The ability to order different things within the manifold of the system allow continuities to be determined especially when they are compared with background variables such as space, time, agent and function viewpoints<sup>2</sup>. Once we allow that there different instances of variables then we acknowledge that there can be different ramified meta-levels of relations between things in the system so that the epistemological framework of Klir naturally evolves to solve the paradoxes of spacetime embedding. Also abstract conceptual ramified sets of higher logical types may appear in order to encapsulate the design of the system. These two kinds of ramified meta-levels are associated with logos and physis dualism that we tend to project on all things. The two ramified meta-level sets interact to define different meta-levels of change and learning. Within this dualistic framework continuities exist to trace the dynamics of the instances of things that make up the gestalt of the system as it arises from the meta-systemic background. So Thirds arise through the positing of instances of objects and continuities that connect them over distances in spacetime or partially order them with respect to agency and function. Systems exhibit synergy in which a single part or relation will function in multiply overdetermined ways. So every system like an organism exhibits some degree of synergy through the continuities and discontinuities that exist within it. When symmetries exist instead of synergies then we see meta-systemic complementarities instead of systems. Synergies and exclusionary complementarities of symmetries co-define each other so that the thing can be seen as either a whole greater than the sum of its parts or a whole less than the sum of its parts.

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So we can see any system as coming into existence by the progressive stages of its ordering rather than by the appearance of things within it and their relations alone. Each system as a gestalt appears to strive to produce a continuity through which its dynamics can be expressed. This apparent teleology is an artifact of our projection of illusory continuities on existence. We assume that every variable should be fully ordered by the real numbers but often real systems cannot rise to this ideal level of the production of illusory continuity that would give perfect intertransformability as defined by an algebra. Some systems are incompletely ordered, not just undecidable and indistinct but under or only quasi-ordered. Something and nothing are not just articulated by the ramified framework of meta-levels but also exist in relations of undecidability, indistinguishability, indeterminateness as to kind, and under quasi-order. Each kind of system may be partially submerged in the mire of inarticulateness to a different extent. And this submergence might be intrinsic and essential not just a product of a lack of rigor or neglect. The lack of complete order in the agent and function views on real-time system design is an example.

But what happens when a system achieves perfect rigor of complete continuity, determinateness, decidability, and distinguishability, is it possible to move beyond this ideal? That ideal is the definition of the dynamic system gestalt that has been isolated and highlighted by the rigor of science rendering it clear and distinct -- cut off from its meta-systemic shadow. But this ideal is difficult to maintain. It is possible to go beyond the definition of the general formal-structural system into the realm of the special systems. We do that by moving to the different levels of archetypal algebras beyond the perfectly intertransformable algebra of the real numbers. When we move beyond the algebra of the real number into the hyper-complex algebras there are three steps beyond the fulcrum of perfect continuity and complete order. These balance the three steps that led up to that threshold as order congealed. Here instead we get a fragmentation between timestreams of continuity represented by the ordered variables of the system. Different timestreams of continuity are held in conjunction and through that we distinguish between different kinds of numbers which we call imaginary. There are three algebras beyond the real numbers associated with the complex number, quaternion, and octonion numbers. They are called the alternating division algebras produced by the Cayley-Dickson process. These three thresholds of complexity beyond the threshold of the real numbers are analogous to the dissipative, autopoietic and reflexive special systems. The special systems deal with the intertransformability between streams of continuity held together yet apart. They go beyond the normal case of general systems in which a single form of continuity exists and where all the numbers associated with variables are real.

In both relativity theory and quantum mechanics complex numbers are used for particular purposes. In relativity theory they are used to express the strange relation of time to space. In quantum mechanics they are used to express the non-locality of particle interactions in the S-matrix. But rarely do we encounter Quaternions (3

imaginaries) and Octonions (7 imaginaries). Quaternions were discovered by Hamilton in 1850<sup>1</sup> and soon after Graves discovered Octonions<sup>2</sup>. What was unexpected was that this series abruptly comes to an end when we attempt to move to the next level called Sedenions which have fifteen imaginaries. The division property is lost and are thus too weak to give us any of the properties like those we consider normal in algebra. There are an infinite number of these non-associative non-division weak algebras. Our normal algebra is quite unique and exceptional in the richness of its mathematical properties in contrast to the infinite number of non-associative algebras. The four algebras associated with the real, complex, quaternion and octonion numbers stand out as being very special. This is why the systems that are defined by them are considered special. They are like a single peak of perfection in a vast plain of mediocrity of all other possible algebras. Those special systems are isomorphic in structure to these unique and rich algebras that model illusory continuity mathematically. All the non-division non-associative algebras of various kinds including those created by the Cayley-Dickson process produce broken continuities because the division property fails in them. It is only in algebras that uphold and underwrite the division property that can model continuities completely. Within all the other algebras there is an underlying discontinuity with local islands of continuity instead of global continuity based on the operations of intertransformation between number streams.

The meta-systemic operator that corresponds to the system is the creation operator that will be contrast with the annihilation operator that appears at the next level of special system emergence. Where we can think of normal systems as coming into existence incrementally we can see that there are a whole class of systems that are quantal and that spring into existence full blown out of the background of the meta-system. For these systems there is a creation operator that produces from the meta-systemic field (as origin) the whole system. In terms of software applications we can see this as the operation that starts an application as a command given to the operating meta-system. In quantum mechanical field theory there is a similar creation of particle and anti-particle pairs from out of the soup of virtual pairs that are continuously created and destroyed. The quantal creation operation is based on the continuity of the field that forms the background on which the system is created. In this case the temporal discontinuity of the system is based on the spatial continuity of the field that can create the system as a whole out of the fluctuations of the field itself.

The algebras related to the real and complex numbers share the same properties. The complex number algebra arises because certain equations may be solved with them that could not be solved otherwise because they do not have real roots. Together these algebras can be seen to create and destroy systems gestalts. Though the se-

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ries of stages of the introduction of ordering of variables we can see how systems are created. When complex numbers arise it is necessary to have pairs of variables held in conjunction (together yet apart). If conjunction fails then we cannot distinguish between the imaginary and the real parts any longer. This is why vector mathematics was invented by Hamilton. He realized that there was from one perspective no difference between real and imaginary numbers outside the conjunction. But inside the conjunction a symmetry breaking occurs that differentiates the three imaginaries from the one real component. So annihilation arises as the breaking of the conjunction in the  $a+bi$  formation of the complex numbers. When the conjunction fails we fall back into just having two real numbers in a vector formation and the symmetry breaking disappears. So the two algebras that give us the real and complex numbers from a systems theoretic point of view give us creation and annihilation meta-systemic operators.

Similarly at each further state of the arising of algebras that give us the quaternion and octonion we can see from the systems theoretic viewpoint the arising of two further meta-systemic operators. These are associated with the loss of fundamental properties which are different in each case. In the quaternion we lose the commutative property while in the Octonion we lose the associative property. When we move beyond the alternating division algebras to the Sedenion we also lose the division property. Thus with each further state our algebras weaken until we no longer consider them mathematically interesting. The inability to reverse operations leads to the arising of a mutual action meta-systemic operator while the inability to re-associate them at will leads to the arising of a gestalt pattern formation meta-systemic operator. Three of these operators were first identified by Goertzel in a paper refining his ‘magician’ Self-Generating System (SGS) formulations<sup>1</sup>. The creation operator was introduced by the author to round out the set and to introduce the spontaneous creation or radical emergence to the SGS theory. These two meta-systemic operators (mutual action and gestalt pattern formation) are complementary pairs like the creation and annihilation operators. Together these four operators define what might be called Emergent Meta-systems. We can see them in the production of virtual particles that form the background of conserved particles in physics. Virtual particles are created out of the field and annihilate each other before the time limit set by Planck’s constant is reached. Thus space is made up of a soup of created and annihilated virtual particle pairs that form the background against which so called ‘real’ particles exist upon. But the truth is that these virtual particles are needed to represent field interactions of the ‘real’ particles so that the real particles could not exist as they do without the virtual particles that they are distinguished from by conservation laws. Thus the virtual particles as a condition for the existence of the ‘real’ particles are just as *real* as they are. The two kinds of particles together constitute the reality of particles embedded in a field in spacetime. Virtual particles themselves can mutually

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interact in the brief time that they exist not only with themselves but also with ‘real’ particles. And because they can be ‘seen’ in the effects they have on other particles there is a peculiar gestalt pattern formation associated with the activity of virtual particles. There is, of course, no direct observation of them as Planck’s constant defines the limit of resolution. But we see the effects of virtual particles in the effects that occur in bubble chambers on the observable ‘real’ particles. Thus we see that because of the observability of effects and the possible mutual action that allows those effects to propagate virtual particles exhibit all the meta-systemic operators characteristics. And that is because the fabric of virtual particles underlying observable particles is the meta-system that is the arena within the system of conserved and observable particles operate within. The virtual particle background is another name for the meta-system of the system of particle interactions that occur as embedded in spacetime.

Emergent Meta-Systems (EMS) is a model of the pure meta-system that arises at the sedenion level in the articulation of the partial meta-systems that correspond to the division algebras. Emergent Meta-Systems may be defined as consisting of the aspects that underlie Spencer-Brown’s Laws of Form (i.e. something, nothing, leveling and multiplicity) together with the four meta-systemic operators (creation, annihilation, mutual action and gestalt pattern formation) that allow them to become a model that extends Goertzel’s Magician SGS model by adding the possibility of radical emergence or spontaneous creation (i.e. a true creation out of nothing operator). Emergent Meta-Systems are in Peirce’s terms ‘firsts’ which have no external relations to each other to hold them into static formations. Instead, they only have internal projected relations to each other in a similar manner as elements in Yuri Gurevich’s Evolving Algebras. Thus Emergent Meta-Systems components swarm and form a rhizomatic collage or mosaic rather than an architectonic structure. The projection onto each other of internal relations by member of the swarm is accomplished by the mutual action and gestalt pattern formation operators. Within the swarm there is a process of communal creation and destruction that produces a life cycle which assumes basic discontinuity rather than continuity of the swarm and its components in time or space. Time itself is split into timestreams which are different for each member of the swarm. Interoperability between time streams is achieved through the successively weakened algebras. But also with individual timestreams there may be discontinuity as members of the Emergent Meta-System appear and disappear in different life-cycle phases. This discontinuity is radicalized when we enter the Sedenion and higher level non-associative non-division algebras where the timestreams themselves become circular as the division property fails. At most only eight timestreams may remain associative within the swarm. This radical discontinuity at which point the swarm becomes a meta-systems introduces the necessity of the consideration of radical emergence or spontaneous creation as an important aspect of the swarm.

Therefore, we see that from the viewpoint of Peirce in Emergent Meta-Systems continuity becomes fragmented by the splitting of timestreams and eventually the production of circular timestreams (called by some cyclical or eternally returning time) when linearity fails at the Sedenion level. Relations between components are internalized to the extent that Emergent Meta-Systems components externally are Leibnizian Monads with no external relations to each other at all. The only way to get a view of external relations within the swarm is to make a fuzzy summary of internally projected relations. Thus the swarm of discrete monads exists in a halo of possible relations between the components. Here we see that by taking the view of Leibniz concerning the existence of monads it is possible to see how they project internal relations instead of participating in external relations with other monads. Thus the deterministic projection of each monad of relations internally appears externally as a fuzzy summary over all the projections. In this way the monads themselves may remain probabilistic actualities within the swarm and be seen as discretely quantized in spacetime. But the mixture of the internal continuity and the external discontinuity of probability allows the approximation of rhizomatic Wild Being. The swarm that creates itself as a self-generating system becomes the ideal model of the chaotic system. But the chaos of creation and destruction of self-generating components exists against the picture of the whole as a fuzzy summary of internally projected deterministic (continuous) relations by each monad on to all the others.

So here we see how the EMS structure uses the four different kinds of mathematics to produce a working model of the dynamic synergies of the meta-system. Similarly we can see how the swarm itself can be pictured as a multi-dimensional grid that contains computational monads which produce these internal projections which are summarized by a fuzzy maximum or minimum. That set of internally projected relations may be seen as the design of the systems architecture. Because we have not allowed external relations between monads but demanded that they have an interior that arises in the laws of pattern, but is denied by the laws of form then we are able to treat the monadic creation and destruction in terms of a genetic algorithm such as those developed by John Holland<sup>1</sup>. In this way we can see how we might explore the design landscape as an internal representation by successive generations of EMS monads within a swarm. Requirements become fitness relations and monadic swarms evolve to fit those constraints by a evolutionary search for optimal configurations of the internally projected archetypal relations.

This radical suppression of external relations (Peircian Seconds) and continuity (Peircian Thirds) leads to a peculiar form of synergy. That synergy appears particularly in the formation of the quaternion which might be called a mediated hyperlist. In other words the formation is a Non-well-founded Set (Aczel<sup>2</sup>) with ad-

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ditional list like properties which allows repetition of individuals of the same kind and some ordering. It is called mediated because no set can be directly a member of itself but may be a member of a set that is included within itself. This peculiar synergy in which elements may be reused by themselves but not directly (only through the mediation of another) may be called following George Leonard ‘holoidal.’<sup>1</sup> It is the synergy of global interpenetration. The swarm interpenetrates through the realization of multilevel conjunction under the auspices of the Division Algebras. This is similar to the multi-connected multi-wormholed landscape that may appear in surreal numbers that was mentioned before. The multiple mappings back on itself and the multiple wormholes through itself create something analogous to the non-well-founded hyperlist that is reusing itself though the other in a mediated self-embedding self-recursion though the Other. This is the process of creating the rhizomatic landscape of that Merleau-Ponty called ‘Flesh’. In Wild Being the self and other are chaotically mixed as are order/disorder, and continuity/discontinuity. So in the swarms Firsts (as radical emergences or computational monads) and Fourths (as synergies or interpenetrations) predominate over Seconds (internalized relations) and Thirds (broken continuities). This produces a model of the meta-system or general economy which is complementary to the system as defined in General Systems Theory. In the system or the restricted economy external relations and illusory continuities are sustained over against synergies of monads. Mutual action and gestalt pattern formation may appear in the Meta-system because of the background of radical discontinuity. Continuities not discontinuities must be proven in the meta-system. These are continuities of action and perception that go against the grain of the discontinuities created by continual creation and destruction of monadic components by the swarm. The social character of the swarm is levied against the monadic character of the individual concrete components of the swarm. Via mutual action and group perception production the collusions are created that allow persistence to exist within the evolution of the swarm. This creation/annihilation represent dynamic forces of discontinuity while mutual action/ gestalt pattern formation represent the social cohesion and collusion that makes the swarm a mosaic instead of merely a collage within the rhizomatic ‘Flesh’ of the swarm dancing in the social fabric of Wild Being.

It is of interest that the Emergent Meta-System formation can be seen to have a precise model in the age old game of Go in Japan or Wu Chi from China. This fact makes it clear that knowledge of the Emergent Meta-System formation is very ancient. Basically we can see this if we understand that in playing the game of Go we are oscillating between Gestalt Pattern Formation as we look at the pattern of the stones at any turn of play and Mutual Action when we play a stone and thus diacritically alter the relations between all the other stones. This oscillation occurs in both players of the game of Go, continually getting new pattern formations and continually moving in such a way that it effects the valuation of every stone on the board.

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But it is only when we consider the what goes on beyond the borders of the game proper that we can see the Emergent Meta-System formation in its entirety. We see when the players decide to stop playing there is an accounting that redistributes the stones such that it is clearer who has the most empty spots. It is these empty spots that are counted. This is a reverse gestalt from the one that was developed as one played the game where the stones themselves were the focus of attention. Now the holes that are left and surrounded by a particular player are the most important aspect of the game and defines its true goal which is to control more holes than one's opponent. But we go further because we not only decide who won but also calculate the handicap for the next game. This handicap is calculated by taking the winning score and dividing by nine. This calculation gives the number of handicap stones the losing player should have in the next game. These handicap stones are placed on the board at designated spots prior to the beginning of play. The handicap stones are the seeds of the power structure of the weaker player for the next game. They are placed in non-optimal places so that they give support but do not immediately confer advantage. They are placed at just the spots that the weaker player will be able to use them when he attempts to connect his disparate groups of stones in the middle game. So if we understand the handicap stones as seeds then it will be clear that these seeds were truly produced out of nothing, i.e. the holes that the players were attempting to conserve in the last game. So something was produced out of nothing. But beyond that we can see that these holes are the candidates that cancel each other out to produce the seeds for the next game or generation of the swarm of monads (stones). So we see the stones as monads, the handicap stones as seeds and the holes that are conserved as candidates. What we lack to have a full EMS formation is the viewpoints. The viewpoints seen in the game as the eyes that allow groups to become invincible. These special holes make a group viable and when paired make it so that the group cannot be taken by the opponents. So candidates and viewpoints are special kinds of holes in the Go game while monads and seeds are special kinds of stones. The viable group is the root of a gestalt that will produce the lasting and stable patterns within the patterning of the Go stones. Thus eye holes in groups are fundamentally related to the pattern formation within the game. Notice that the two remaining operators also appear. The annihilation operator appears in the end of the game when the conserved holes of one player cancel the conserved holes of the other player. Also the creation operator appears when there are seed handicap stones created out of nothing by the rule of nine. Both these operators appear outside the play of the game proper and organize the movement between games which represent the lifecycle generations of the swarming monads. In fact, this analysis of Go may be taken down to its minute-ist details and we see that the way the game is played by two players across multiple games is a precise model of the Emergent Meta-System formation that we have been describing. That EMS formation has been coded into this cultural artifact by the Ancient Chinese. It is a representation of the archetype of the *Dragon* in their culture, that is a picture of the Kosmic Atom that is the archetype for the interface between form and formlessness. Between every two Go games radical emergence is

simulated as the seed handicap stones are indeed generated directly out of nothing, as a side effect of the cancellation by which one player wins and the other loses. Go shows us that depending on the context ‘nothing’ can take on a very concrete negative form. The precision of this ancient artifact shows us that the EMS formation was well known by the ancient Chinese and it was a knowledge that they wanted to survive into their culture’s future so they made a game out of it that would be played by millions of people for the intellectual pleasure of it even though they did not understand its meaning. That meaning has finally surfaced again. Go is a cultural artifact that captures the essence of the Chinese worldview similar to the way Chess is an artifact that captures the essence of the Western Worldview.

In Chess there is the fact that the amount of information needed to differentiate the pieces on one side is exactly the same amount is needed to define the board. Thus there is a transformation between  $2^6$  and  $4^3$ , that is between two dimensional and solid. Both sides pieces in information terms map to the whole playing board so there naturally arises conflict. This kind of transformation first happens at the level where there are 64 distinctions. Next it happens at threshold of 729 distinctions. But 64 is the first threshold where such a transformation can be made without losing any information. This transformation is indicative of a basic Indo-European cultural trait that objects that are simultaneously operations are preferred. We can see this in language where the words shape *shapes*, form *forms* can be either nouns or verbs. G. Spencer Brown has formalized this in his Laws of Form in which *Marks* are both operators and operands. Chess represents this chiasm between the operator and the operand in the fact that the places in Chess and the things that move in those places have the same information content. The pieces are the forms that move and that same information when transformed produces the place within which the movement takes place, and is thus the form of the board within which the forms of the pieces move. The Chiasm between noun and verb represents perfect action within the Indo-European worldview. But notice that in the clockwork mechanism of the Chess game empty space plays no active role as it does in the Go game. Each game is separate and does not contribute seeds of handicap stones from the last game that are created out of the annihilation of the valuable ‘nothing’ produce in the game by the gestalts and the mutual effecting moves. So we can see that the Chess game is blind to the role played by ‘nothing’ in the game. The hole focus is upon objects and their synergetic movements as a team in clockwork complex moves within the empty space of the board. Go on the other hand does not allow for the movement of the stones. Instead the static board is the source of many gestalt formations as we see the board differently as each stone is added to the tableau. This difference between the stasis of Go and the dynamics of Chess is striking. But what is not seen on the surface is that the dynamic in Go is across many games between the same players. If you watch the patterns that occur at the end of play over a series of games one notices the swirling patterns of the final groups after they have been rearranged for counting. So there is dynamism but it is more subtle and is across game generations rather than within

the game itself. The chiasm of noun and verb is an important underpinning of the Indo-European world view that will produce maximally efficient synthetic machines. Today we call it the unity of form and function. But the Chinese insight has to do not with form and function's unity but the relation between form and formlessness. It has a particular structure that we conceptualize in the Emergent Meta-system formation but which has been available in a concrete embodiment as the game of Go for thousands of years. At the interface between form and formlessness there is a reflective co-production where nothing and something produce each other. Within the Western tradition we only get this insight in some fringe theosophical texts whereas in China it was a central focus of all artistic creation<sup>1</sup> and as we see now their intellectual games as well. It is important to recognize that the EMS structure has an embodiment in Go because it brings it out of the esoteric theoretical realm and places it in a realm of intellectual gaming that everyone has access to. All you need to do is learn to play Go and you will have an intuitive understanding of the Emergent Meta-System formation.

Emergent Meta-Systems contain a meta-algebra with four operations (creation, annihilation, mutual action, and gestalt pattern formation) that operate upon the aspects that underlie the Laws of Form (something, nothing, layering, and multiplicity). Each operator of the meta-algebra derives from either normal algebra or one of the hypercomplex algebras through the emergence of properties at each algebraic level. It is the emergent properties of the algebras that become the meta-systemic operators of the meta-algebra. We will now track this unfolding process step by step through its four stages. Assuming that the system may be created by the imposition of order that reaches culmination in the production of continuity, we start from that foundation that defines the possibilities of General Systems Theory to explore the successive arising of the emergent special systems until we reach the limit at which the meta-systems arise. This series of stages allow us to build complex analogies between Hypercomplex algebras and the theory of special systems and meta-systems. The analogy has the form:

Figure 6:

***real : system***  
***:: complexnion : dissipative special system***  
***:: quaternion : autopoietic special system***  
***:: octonion : reflexive special system***  
***:: sedenion (or higher) : meta-system***

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1. *The Propensity of Things*

This analogy exists because the mathematical necessity of alternating division algebras as a very special structure is embedded in the nomos beyond the split between logos (mathematics in the mind) and physus (physical systems). It is the intrinsic non-duality of existence that makes gives force to the analogy. But the analogy only holds in very special circumstances that occur beyond the restricted economy of systems as we move out toward the comprehension of the meta-system. They are invisible as long as we are only looking at systems and ignoring their meta-systemic shadows. But in the vary special circumstances where conjunctions of the type that manifest in hypercomplex alternating division algebras can be sustained in physical, chemical, organic, psychological or social realms then these special systems arise in reality and exert a tremendous influence on the environment as we can see in our world from the existence of life, consciousness and social formations. This is because these special conjunctions are ultra-efficient and as such have a tremendous advantage over normal systems that are not neg-entropic. These are not perpetual motion machines. Instead they are the inverse of perpetual motion machines. Those machines attempt to circumvent entropy by conserving or creating energy. Instead, special systems do not circumvent entropy to become ultra-efficient. Instead they operate far from equilibrium and thus use energy but in a way that is neg-entropic through the conservation of information and thus order in the face of and in spite of entropy. Special systems are perpetual information producers instead of perpetual motion or energy producers. Information flows out of nowhere to continually reorder the dissipative, autopoietic and reflexive special systems and this is what allows them to be neg-entropic locally in spite of the dominance of global entropy.

## 2. Dissipative Complexnion Special Systems

Conjunction of timestreams of continuity occurs at specific thresholds of complexity that are defined algebraically. The first threshold arises when the real numbers are conjuncted with another kind of number that we call imaginary. This is defined by special group relations of intertransformability between continuous timestreams. This algebra treats the vectors of combined real and imaginary numbers and has all the properties of the algebra of real numbers. But the strange thing is that there is a twist in the transformation that is much like an Escher waterfall. The Escher waterfall is built upon the concept of the Penrose Triangle which is the sine quo non of optical illusions in which coherent local relations are combined to form a globally paradoxical and impossible figure. But what is impossible in three dimensions becomes possible in four dimensions. What is not normally realized is that the Penrose triangle is the dual of the Mobius Strip which offers local duality and non-local non-duality in a concrete geometrical form. The Penrose triangle uses the non-local discontinuities that appear in Riemann geometry to create an overall picture that is paradoxical when expressed in three dimensions. Four dimensionality allows the forbidden connections that make the figure impossible in three dimensions. But this connection to globally discontinuous space allows us to see that the Penrose Triangle

represents the local/global disconnect in terms of space while the Mobius strip offers the same disconnect in the figure that inhabits the space. Thus, the Penrose triangle and Mobius strip duality fit together closely as the disconnected global space and the lack of duality in the global nature of the figure in the space. On the other hand, there is the local continuity of the space the figure occupies at the same time as the figure itself embodies duality locally within itself. Both the Mobius strip and the Penrose triangle exemplify dual perspectives on a certain higher dimensional twist that exists in nature and in mind in terms of mathematical objects. This higher dimensional twist is exactly the form that the dissipative special system needs to define itself. In fact, we can say that the neg-entropy within the dissipative system is equivalent to the reversal of time in which non-intuitively things fuse back together on a continual basis rather than falling apart as we would normally expect like in a film which is run backward though the images of an explosion. This only occurs in some very special anomolous cases but when it does occur as a rare event in speical circumstances it has spectacular consequences. Witness for example the effects of living systems on the planet, or consciousness or social organization of organisms. Dissipative systems pour order from nowhere into somewhere to create the dissipative phenomena that progresses from a central singularity to an outer boundary with the environment. The imaginary numbers define this singularity as the square root of negative one in the number field and allow the twist that would make it possible for order to come as if form nowhere, where it is really being filtered through a potential tough shaped like an Escher waterfall that connects the singularity to the boundary of the system. The disordering of the environment outside the boundary becomes the source for the order that continually pours into the system from nowhere.

Dissipative systems have boundaries and interior singularities from which ordering patterns arise that push out toward the boundaries and beyond to enlarge the reach of the dissipative system. Dissipative systems are neg-entropic as they are self-ordering dynamics far from equilibrium that push out disordering the environment as they impose their own ordering as the boundary expands. In the dissipative system there is local neg-entropy within a field that preserves entropy globally. This means that there is a local imbalance in the global entropic field that makes it possible for a negative entropic situation to occur. But the connection between global disordering and local ordering forms a whole that globally maintains entropy. This relation between global and local order can be thought of in terms of a mobius strip. The mobius strip is globally one-sided but locally two sided. So the local two sided effect is an illusion created by our perspective on the mobius strip at one particular point. Similarly we can see a dissipative system as recycling order through a tough of potentiality so that the disorder to the environment can be seen as reentering the system as order from the singularity within the dissipative system. We notice in fact that the ordering of these systems is preserved over time and follows certain rules. We can model these systems with cellular automata in which the rules for the cells that apply to all cells can be seen as the source of order from nowhere and the apparent patterns

that occur from local interactions among cells is really an illusion of difference that flows from looking at local context. The patterning of the cellular automata by local interactions of globally constant rules display the same dissonance between local/global patterning that occurs in the dissipative system. So when we describe the dissipative system we can see it as an circular flow of order that goes out from the singularity toward the boundary and that at the boundary enters a potential trough and is recycled back to the singularity. This ordering cycle interacts at the boundary of the dissipative system and disorders the environment as the boundary expands. It is as if the ordering principle bounces off the boundary and deflects back toward the focus of the singularity. In fact, this is very similar to the model of the way solitons are maintained in their troughs as partial waves bounce off the walls of the trough to maintain the soliton. This interaction which accelerates the disordering of the environment before submitting it to a new order is where the surplus of disorder is produced that re-balances entropy equation. The boundary is larger than the singularity in its influence so there is on balance always more disorder produced than there is order.

The meta-systemic operation associated with the dissipative complexnionic special system is annihilation. That appears as the breaking of continuity longitudinally instead of crosswise. Crosswise breaks occur after the division algebras have been exhausted. We are cutting down the middle of continuous strips instead of across them. These form mobius strips. When we cut a mobius strip longitudinally we get two two sided strips but when we realize that they are part of a higher unity then we go to the next level of mobius twisting which is the Klinean bottle. When you cut a Klinean bottle in half you get two mobius strips. We posit that there is also a hyper-Klinean bottle<sup>1</sup> which when cut yields a two Klinean bottle which when cut yields two mobius strips that when cut yield two two sided strips or normal continuities.

We can define the dissipative special systems as “openly closed” in relation to its environment. It is open to energy which drives it far from thermodynamic equilibrium, but closed to information which circulates impossibility from nowhere into the system a order production radiating from the singularity out towards the boundary where the system expands disordering the environment, creating more disorder in the environment than order in the system. And the transformation of order of the system into disorder for the environment causes the dimensional transgression which allows the information to loop back around re-entering the singularity. Think of this loop as a kind of regulation mechanism that continues a certain load of order production because it encounters no resistance in disordering the environment. If the environment does resist then it would shift to a new kind of order revealing something of the implicate order (cf Bohm) behind the order production of the dissipative system.

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1. This speculation is unverified.

Extending the paradox even further we realize that the information driving the dissipative system is infinite and is revealed to us as a strange attractor if we look at the phase space of the system. So although the information loop is closed due to the strange attractor formation there is infinite information traveling around that loop so that this feedback loop is strangely open. Also, the system that is open to energy is actively producing its own spatiotemporal boundary creating a closure which is finite. Thus the dissipative special system embodies paradox which we see as neg-entropic propagation of order in spite of the predominance of entropy in special cases of non-linear thermodynamics as described by Prigogine<sup>1</sup>. We note that there have been a continual history of attempts to produce perceptual motion machines which attempt to realize the Escher waterfall formation as a functional physical system. The second and third laws of thermodynamics deny that possibility with respect to energy. Perpetual motion machines set over the dichotomy between dynamic reversal and irreversible thermodynamic systems as a paradoxical formation which would seek to connect them in such a way as to produce energy or at least maintain the energetically non-entropic system without energy inputs. But this is an impossible paradox to sustain physically. The closest we can get physically is the soliton formation which is super-efficient not ultra-efficient. Super-efficiency gives unexpectedly high persistence without complete permanence to the isolated dissipative system. Ultra-efficiency only arises at the autopoietic level. However, where we cannot achieve energy closure or energy production it is possible to achieve information closure and production. Thus, the perpetual motion machine is the dual inverse of the dissipative special system. What the perpetual motion machine fails to produce in terms of energy is exactly what the dissipative system succeeds in producing from the point of view of information. We note following ?XXXXX? that information and energy are intertwined such that potential energy is really situational information, so that physical systems are continuously transforming energy into information and vice versa as they produce and then use potential energy. A dissipative system merely produces a loop in this potential trough such that the energy converted into information is returned from the boundary of the dissipative system to be reconverted into ordered energy (information encoded energy) that radiates from the singularity appearing from nowhere at the center of the system. The loop though the potential space of the recycled information creates a surplus of ordering and maintains the order of the dissipative system within its boundary.

We can understand this potential loop by considering again the duality between the Penrose Triangle and the mobius strip. The former allows us to compare global incoherence to local coherence whereas the latter allows us to compare global non-duality to local duality. The paradoxicality of the dissipative system may be expressed as the conjunction between these two local/global distinctions which are construed together to create a single paradoxical meta-formation. What is surprising

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is that it is possible to create embodiments of this paradoxical formation unlike its perpetual motion dual. In other words, there are potential troughs that can be made reentrant for information whereas this is apparently impossible for energy. The point where information disappears at the boundary of the dissipative system is directly connected to the singularity where it re-appears at the center of the system. At that point we enter an actively contradictory state which is at once globally non-dual and globally incoherent. This dissipative system itself embodies local dual distinctions and local coherence. The inside of the finite dissipative system is entirely locally coherent and dualistic distinctions of relevance is between the singularity and the boundary that encloses that local distinguishability and coherence. It is the global non-duality and non-coherence of this system that allows it to manifest its startling properties of neg-entropic order production that violates our thermodynamic expectations. The coincidence of global non-duality like that which appears in the mobius strip and global non-coherence like that which appears in the the Penrose triangle make the dissipative special system formation especially incomprehensible. In other words, we get a property we want which is global non-duality at the cost of global incoherence. The mobius strip is a finite formation that is possible in three dimensional space. We see that the Penrose triangle has the same structure as Riemann spacetime which is also has global non-Euclidean properties combined with local Euclidean properties. Note that spacetime is the ultimate meta-system and as such it has both global incoherence and non-duality in that without something inhabiting space there is no distinctions between places or times. This analogy with the meta-system extends to the micro-quantum level where we see spacetime as a soup of virtual particle pairs that are continually created and destroyed. These virtual particles also display the operations of the Emergent Meta-System as has been mentioned previously. Thus whether looked at relativeistically or through the lens of quantum mechanics spacetime has inherently the nature of the meta-system<sup>1</sup>.

So when we put these two formations together we get a meta-formation that uses global incoherence from four dimensional space to wrap back around creating a closed loop through the potential space that stands outside physical spacetime. Local distinctions that are dual collapse into non-dual modes as it passes though the incoherent discontinuities in the global spacetime. The fact that this occurs in spacetime means that the dissipative system must be a dynamic irreversible process in order to accomplish its strange feat of neg-entropy production.

The arising of a nexus of non-dual non-coherence is precisely our entry point into the meta-systemic. Each successive special system takes us further toward the utter incompleteness and inconsistent as well as incoherent meta-systemic back-

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1. We see this too in the difference between the view of the Matix as either spacetime (x+y+z-it) or timespace (past-present-future+nowhere, the Minkowski view). The Matrix refers to what lies beyond these complementary views that is not accessible to observation.

ground of all systems. In meta-systems we have nexes of complementarities whose existence forces us to an anti-epistemological stance that is advocated by Arcady Plotnitsky in his study of Bohr, Derrida and Bataille called Complementarities<sup>1</sup>. It also forces us into a similarly anti-ontological stance that leads to positing of emptiness (sunyata) over against any type of Being. Each special system can be seen as a partial meta-system. We are building up from a nexus of complementarities step by step. In the autopoietic special system we get a balance between non-dual non-coherence toward a nexus of complementarities step by step. In the autopoietic special system we get a balance between non-dual non-coherent dissipative formations and then finally in the reflexive special system we get a minimal system of non-dual non-coherent nexes. The reflective special system is a nucleated systemic formation analogous to the Vector Equilibrium<sup>2</sup> of B. Fuller defined in Synergetics I & II<sup>3</sup>. So the minimal system of non-dual non-coherent nexes is directly related to the close packing of spheres around a nuclear sphere. Working backward we can see that the pair of non-dual non-coherent nexes is related to the tetrahedral minimal system and the dissipative system with a single non-dual non-coherent nexus is related to the triangle. That triangle may be construed as the Penrose triangle or as a mobius strip in which each corner is a twist. We build up the tetrahedron from triangles. The interaction of the tetrahedral minimal systems can be expressed by the fusion into octahedron or the interpenetration into cubes. With the cube the square appears. Cubes and squares together produce the vector equilibrium structure. As Onar Aam<sup>4</sup> has shown the associative properties of the Octonion are related to the vector equilibrium and the associative properties of the quaternion are related to the triangle. The vector equilibrium is the chiasmic non-dual balance point between octohedron and cube. Its associativity comes from the interaction of the triangle and square that appears in the octonion as relations between imaginaries. But prior to the interaction of tetrahedra that gives rise to the square there is only the interaction of triangles that form the tetrahedron. We can see the tetrahedron as the set of rotations of the triangle producing a symmetry space. We can see the Vector Equilibrium as a set of rotations of a triangle and square that introduces a higher order symmetry space. When we look at these symmetry spaces we see that they have an inner structure of quaternion and octonion algebras. Higher algebras like the Sedenion have islands of associativity within an overall non-associative algebraic formation. When commutativity, associativity, and division properties disappear we have full global non-coherence of the meta-system. It is precisely at that point we also enter into full non-duality of the anti-epistemological and anti-ontological emptiness (void) as expressing the universal interpenetration. Between the arising of the nexus of non-dual non-coherence in the dissipative system and the full fledged interpenetration of the Sedenion and higher order non-associative non-division algebras produced in the Cayley-Dickson process

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there are two more states where partial meta-systems arise as thresholds of complexity of a very peculiar kind of defining anomalous and strange special systems that spontaneously arise between systems and meta-systems.

At the dissipative level there is a chiasmic fusion of pattern and form. We have seen that Spencer-Brown's Laws of Form may be used to define a calculus of Form through a particular combination of the aspects of form (something, nothing, layering, and multiplicity). These laws of form have a dual which may be called the "laws of pattern" which assumes the opposite axioms.

Figure 7:

$()() = \text{"nothing"}$

$(( )) = ()$

The laws of pattern emphasize or reward layering instead of multiplicity. Multiplicity emphasizes outward differentiation whereas layering emphasizes inward differentiation. Content is the inward differentiation of a form and the ordering of that content represents a patterning. The calculus of pattern is eschewed by mathematicians because it is considered more shallow than a formal calculus that represents dualistic transcendence over content. In fact, only ?XXXXX? has developed a mathematical exposition of Pattern. Patterns can easily break the rules of isomorphism and homeomorphism that mathematics cherishes. Patterns can be realized as the subtle sets of overlappings of the shadows of forms and no mathematics of overlappings exists. We posit that such a mathematics could be thought of as a fuzzified category theory. Such a conception has allowed the definition of anti-categories such as the annihilation mosaics<sup>1</sup>. Emergent Meta-systems can be modeled as annihilation mosaics. In the annihilation mosaic there is a set of eventities and anti-eventities that annihilate each other continuously like particles and anti-particles in the soup of virtual particles that server as the field for conserved particles. Each annihilation can produce a set of side-effects such as other particles which may produce annihilation cascades that in turn may form loops. These loops in annihilation mosaics account for the persistence of things in the face of constant annihilation. We may postulate that what the forms contain as contents is precisely these annihilation mosaics that allow us to see pattern rather than form. In annihilation two somethings yield nothing so that multiplicity is constantly collapsing. But, instead of the multiplicities this process produces layering. The layering piles up within the form as overlapping shadows that continuously reduces to just the form itself. So patterns of overlapping elements create forms that in turn annihilate. The "laws of pattern" would merely vanish if it were not for the fact that annihilations can produce side-effects that cascade and can create loops. It is these loops that form stable dynamical structures sim-

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ilar to the stable static structures of forms. The pair of static stable and dynamic stable structures together form a gestalt that can be construed as a system. In fact, we recognize this as a temporal gestalt in which forms produced by the buildup of layered patterns and forms together produce multiplicities that may be manipulated by the laws of form calculus. From a notational viewpoint we can distinguish between laws of pattern and laws of form axioms by introducing brackets around laws of pattern expressions:  $((0)(0))\{0((00)((0)0))\}(((0)(0)))0$ . But this contrast between pattern and form does not complete the story because the laws of pattern merely defines the dynamics of overlapping and annihilation. Still we must consider the nature of the content itself. We have already seen that it is necessary to posit that the forms contain a representation of field propensities in order for our model to be complete from the point of view of the four kinds of Being. We represent these field propensities via Surreal Numbers. Surreal numbers may represent either quality or quantity. They represent quantity in the way that Conway<sup>1</sup> and Knuth<sup>2</sup> have defined by progressive bisection that generates all real numbers plus all ranks of infinite numbers and infinitesimals from a single symmetry breaking operation. By producing bifurcations of up and down markers at various ordinal levels all possible numbers are produced as well as some holes or anti-numbers which prevent us from integrating under the surreal numbers. Thus, the surreal numbers naturally forms a broken semi-continuity. When numbers define sets of entities and we interpenetrate these entities, then we get the possible qualitative states of a system. In this we move from  $n^2$  to  $2^n$  that numerically defines the relation between quantity and quality for a given system of elements. If we take any set of components, the Lano  $N^2$  diagram<sup>3</sup> defines the static relations between these components that appears in a gestalt pattern formation that glosses over all the components. But then there is also the mutual action of the components with each other that we only see in their interaction in which they form a dynamical system, or a moving gestalt. These interactions give rise to systemic qualities. These qualities are expressed as the tension between foreground figure component and the rest of the components forced into the background in a particular gestalt view of the dynamical system. The tension between the one components and the rest has an affinity with the relation between the interpenetrations of the components within the overall system. The possible interpenetrations are  $2^n$  where  $n$  is a set of distinctions that can be hierarchically combined to produce a set of possible states. The dynamic system has a normal trajectory through this state space. But all possible qualitative trajectories are represented within the state space. The interpenetration of the different kinds of things in the initial set can be seen as the dual of the set of possible qualities of those things interacting dynamically. Each combination of ups and downs may represent besides numbers instead a particular qualitative permutation of possible distinctions that make a difference for that system and thus de-

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fine the possible system states. Thus surreal numbers may define either the quantity or quality using the same notation. When we realize that propensities are exactly half way between qualitative possibilities and quantitative probabilities then we see that it is reasonable for the surreal numbers within the forms to represent moments of the field of propensities thus:  $(\forall \wedge \wedge \wedge \forall) \{ (\wedge \forall) \} ((\wedge \wedge \forall \wedge \wedge) \wedge \wedge \forall)$ . Now what is amazing is that the surreal numbers with their infinities and infinitesimals and holes are a perfect model for the meta-systemic field. In that field there is the representation of the primary complementarity between up and down arrows. That field contains blackholes and miracles of decreasing and increasing positive feedback represented by the infinities and infinitesimals. But the field also contains holes or gaps in continuity similar to those that the division and non-division algebras introduce. If we take the infinities or infinitesimals and randomly connect those bumps on the surreal surface OR we take the holes and randomly connect them we get a multiply connected surreal surface. That surface represents the true nature of the global economy of the meta-system. If we think of that surface as involuting then each hole takes in the entire surface and then reproduces it again from inside itself. This is the essential vision that Ben Goertzel had in mind when he produced the Magician SGS model of the meta-system<sup>1</sup>. Every toroidal hole is taking in and projecting the whole surface connecting all the toroidal holes. When we put this together with Donaldson's discovery that there is a possibility infinite number of fake four dimensional topologies we see that the multiply connected surface is a four dimensional Swiss cheese structure with infinite mappings between holes and holes or infinities and infinitesimals within a surreal four dimensional manifold.

However, if we think instead of connecting holes and infinities we get a completely different kind of formation, as has already been noted, that is analogous to the dissipative formation. Suddenly we see that this cross-wise connection between infinities (or infinitesimals) gives us the possibility of infinite information appearing from nowhere within the multiply connected surface. The stream of infinite transcendental digits would appear out of a hole in the continuum as a set of random fluctuations. But infinite irrational numbers would appear as cyclical order that arises from nowhere. Either way infinite numbers connected to holes in the continuum is a precise model of the dissipative system that naturally arises within the context of surreal numbers captured by the laws of form equations. Those equations allow us to manipulate the field of propensities and even convolute the field of tendencies represented by the four-dimensional "Swiss cheese surreal" surface. Each hole represents an Emergent Meta-System component within the swarm of holes. Each hole is involuting the entire surface producing the whole out of all its parts. This gives us a dynamic model of interpenetration. And we realize that it is the conjunction of holes which produces the various models of special autopoietic and reflexive systems as well as meta-systemic higher order formations. All the holes taken together are the swarm.

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Within the swarm there are islands of associativity and smaller islands of commutativity. But the swarm as a whole as a meta-system is incoherent and non-dual to the extent that it represents a model of interpenetration. Things in the swarm are literally empty as they are actually holes mapped to either increasing or decreasing infinities from elsewhere on the same surface through which order flows into the surface itself. We can see that the laws of form/pattern equations may be taken as the means of producing the mapping between points on the surface. So in this way it is possible to see the combination of the laws of form/pattern and surreal surfaces as a complete picture of the meta-systemic formation with its special subsets. This is because once we have a picture of how dissipation arises from out of the quality/quantity non-dual substrate of the field then by conjunction of dissipative structures we can build autopoietic and reflexive special systems. Autopoietic special systems appear as homeostatic and symbiotic pairs of dissipative systems whereas reflexive special systems appears as minimal systems of these dissipative structures held in conjunction.

### 3. Autopoietic Quaternionic Systems

When we move to the quaternion threshold of algebraic complexity we enter the realm of multi-level conjunction. A quaternion is a conjunction of two real-imaginary vectors. It is at the same time a pair of dissipative systems and a whole new emergent special system that is analogous to the autopoietic system. In the autopoietic system two dissipative systems combine to form a self regulating hyper-cycle. That is to say that the disordering of the environment by one is the ordering of the other and vice versa. This occurs at the quaternion level of complexity that embodies four dimensional rotation. That is the kind of rotation that allows perpetual motion in four dimensional space. Since our spacetime is four dimensional perpetual motion is possible in very rare instances such as in the phenomena of superconductivity. The autopoietic system maintains its organization homeostatically by the feed back between symbiotic dissipative systems locked into an embrace where they feed off of each other and do not need to interact with anything outside themselves.

At this level one of the important algebraic properties is lost: commutative property. The loss of this algebraic property gives rise to mutual irreversible action and thus behavior in general. Basically this means that an action between nodes in an autopoietic network may take many actions to be reversed and perhaps cannot be reversed due to asymmetries in action. This irreversibility in actions makes mutual action visible within the network of autopoietic nodes. So we say that the meta-systemic operation at this level is mutual action. These are actions that may have side-effects or supplements that cannot be reduced to the original action. In other words the many actions it takes to reverse an action can be seen as the supplement to that action which makes action cycles and sequences long chains where they would be simple reversible atomic actions otherwise. So an autopoietic system has autonomous behavior as a visible characteristic that does not appear at the dissipative or the

general systems levels of the hierarchy of kinds of systems.

An autopoietic system has a boundary that is maintained with its environment. This boundary is permeable and events along the boundary are treated as perturbations that are compensated for by the homeostatic action of the autopoietic system. Within the boundary are nodes that have the function of producing the components of the systems own organization out of the sub-structure of available sub-components. This process of self-production is controlled by a hyper-cycle that is self-regulating. This hyper-cycle exists in the imaginary realm beyond the embodied system as the relations between quaternionic elements. In the hyper-cycle the different elements form a holographic non-well-founded set in which each control element represents the whole of the system at a particular moment in its cyclic homeostatic development. Each holographic control element contains information about the whole system by subsuming all the other holographic control elements as parts of itself.

The crucial distinction at the autopoietic level is between structure and organization. At the dissipative special system level these two cannot be distinguished. But within an autopoietic system there is the distinction between the structural nodes and the organizing epicenters. The structural nodes exist in real spacetime and they produce each other. The organizational epicenters are an articulation of the nowhere beyond the singularity of the dissipative system. In fact, each structural node is a singularity of the type that appears in the dissipative system. So both the singularity of the dissipative system and the imaginary higher dimension become articulated when we move to the autopoietic level of special systems differentiation. The structural nodes are holographic in that each singular node contains an image of the entire system as a template that allows it to build one particular piece of that network that fits in synergetically with all the other pieces produced by the other structural nodes. And this process is driven by the hyper-cycle of imaginary organizational epicenters that control this ordering in spacetime from beyond spacetime. Likewise the organizational nodes are holographic in that each of them is a part of all the others so that they can create a complete compensating control ring that can maintain homeostasis in the midst of perturbations from beyond the boundary of the autopoietic system. Notice here that the boundary of the autopoietic system is assumed to be stable and not expanding and that instead of disorder coming from the dissipative system into the environment as the dissipative system expands, that the disorder is coming from the environment into the autopoietic system which that homeostatic system must continually compensate for in order to maintain its organization in the face of continual structural transformations. The special feature of the autopoietic system is that it may react in multiple ways based on the same input due to differing internal compensatory states.

It is also important to note that homeostasis is based on the ability to have neg-

ative feedback loops and that these loops can be seen as attractors within the autopoietic system boundary that keeps the system cycling close to balance. In fact, we can posit that these homeostatic feedback loops can be used to compensate against each other within the autopoietic system and thus produce stasis as the multiplication of homeostasis against itself. We will call these static structural elements within the autopoietic network structural invariants and contrast them to the homeostatic aspects of the network that do not immediately cancel the action of others. This is what defines the organizational aspect of the autopoietic system which is flexible and will cycle back to a balance when perturbed. The organization controlled by the imaginary hypercycles is the flexible aspect of the autopoietic system that allows it to be within a perturbing environment and maintain its internal balance despite continual unbalancing from the outside.

The autopoietic system is a chiasm of living/cognitive properties. This means that it is a description of a machine that organizes itself and this is taken as a definition of life. But this definition of life does not allow an objective view of the system because it recognizes that the cognitive component is intermingled with the living component so that they cannot be separated. We see this in the fact that we cannot predict as observers what the output of an autopoietic system will be based on any known input. Thus the autopoietic system becomes something that is completely opaque to the external observer who projects his/her theoretical models on this opaque and inexplicable behavioral black hole. And on the inside too the autopoietic system has its own cognitive apparatus fused with the processes of living. So even though theoretically we can separate the structural singular nodes from the organizational imaginary epicenters that produce the hypercycle in practice it is impossible to differentiate these two kinds of nodes. It appears instead that individual singular nodes are acting intelligently within the autopoietic network because the chiasmic nodes are holographic in terms of system patterning on the structural level and holographic in terms of control patterning at the organizational level. So the cognitive and living processes form a phased interval that can appear more or less intelligent from different perspectives. The point is that the nodes themselves as embodied within spacetime are acting in ways that can be ascribed to the attributes of an intelligent living whole which Rescher has broken down into the attributes of a system but which are fused together synergistically in the bodymind of the living thinking organism.

We can follow Shapiro in his book on embodied reflection in saying that structure is the exploration of the possibilities of a form in action. Patterning occurs at the level of content and Formation occurs at the level of the boundaries of things. When we explore the structure of a thing it undergoes deformations in which the contents are transformed and the boundaries containing the boundaries are changed. These are associated with the difference that Husserl makes between noema and noesis when he says that every activity in consciousness is a mixture of the transforma-

tion of contents and actions. So the formal-structural system is merely a whole in which both form and content are dynamically changing over time. We assume along with Aron Gurwitsch that that this always takes place on some background and so this dynamism occurs as a gestalt to the observer. The inability to separate noesis and noema or pattern and behavior means that it forms an interval which from different viewpoints can be seen as contributing more or less content and thus making more or less boundary contribution to the overall effect of the gestalt.

We also follow Shapiro who distinguished between the virtual shadow of perception which is the imagination and the virtual shadow of behavior which is mimicry. These shadows we identify as the meta-systemic side-effects that appear as a halo around the perceptions and actions of the organism. The autopoietic system reinforces its behavior through mimicry and it reinforces its perceptions through imagination. It projects its homeostasis back on itself recursively by mimicking itself and by imagining the possibility of perfect balance that it is approaching iteratively as an asymptotic limit. In the autopoietic system mimicry and imagination are tightly coupled shadows of perception and behavior. Perception is the accepting of perturbations from the environment which is reacted to as the homeostatic system attempts to return to its equilibrium. The behavior is decoupled from the stimulus because the return to equilibrium may not be by a direct path. Because the commutative property has been lost a circuitous route back to balance may need to be taken. As the special system weaves its way back toward balance other perturbations may arise to be compensated for and so the actual behavior of the system could be very different given the same stimulus just as it is with all animals where simple stimulus-response models fail except in extremely constrained environments. The autopoietic system is producing itself to an imaginary template. The main behavior of the autopoietic system is the self-production in which it attempts to mimic itself. So the shadows of imagination and mimicry are tightly coupled because imagination of the balanced system and of the system organization guides the behavior of rebalancing in the face of the loss of the commutative property and the reproduction of itself in the face of constantly shifting structures underlying the organization of the autopoietic system. At the next emergent level these shadows of perception and behavior decouple to allow the projection of the world and self-similarity that can accept difference.

Part of the inspiration for this view of autopoietic systems theory and its relation to the social comes from an in-depth study of Plato's Laws in the author's philosophical opus The Fragmentation of Being and the Path Beyond the Void. In that study it was found that Plato's description of his "Second Best City" is a representation of an autopoietic system in terms of a human city. Most of the studies of Plato concentrates on the best city described in the Republic which is clearly unlivable and is really a description of a city of the gods. Plato's Laws is the first work on systems theory as it gives a complete representation of an imaginary city in a systematic way. This imaginary city, Megara, has many strange features that can be explained easily

once you realize that he is describing an autopoietic unity of the kind described by Varela and Maturana. But the use of autopoietic theory in this way raises the question of whether human social entities can be autopoietic. On the basis of this work I decided that autopoietic theory needed an extension that explained the nature of the social in relation to its constituent organisms but had its own emergent properties. I found the perfect model for this emergent jump from the autopoietic to the social in the jump from the quaternion to the octonion algebras. These analogies then attained a life of their own as I began to work out the counter-intuitive implications of the analogies which ended up explaining some of the most vexing problems in social and psychological science and led also to the realization that knowledge of these structures are encoded into mythology. To be precise the story that predates the Iliad and Odyssey of the voyage of Jason and the Argonauts, but which was recorded later by Apollodorus is a narrative about the formation of the reflexive system out of the ruins of the broken autopoietic system. These mythic parallels plus the evidence of Plato tells us that the knowledge of ultra-efficient systems is ancient. We can also see it inscribed in Chinese Traditional Sciences like Acupuncture. The study of Acupuncture and Homeopathic theory which is anomalous with respect to generally accepted Western medical models is has also informed this work. These medicines each assume that there is an ultra-efficiency that is operant in the human body that can be effected by unconventional medical techniques. They are excellent examples of specific practical sciences that embody autopoietic theory in different forms. Varela has written in The Embodied Mind about the connection of autopoietic theory with Buddhism. But the connection with Acupuncture theory is even clearer and in the case of this Ancient Chinese medical practice there is no religious foundation that has to be accepted in order to appreciate the theory. Instead, one must only accept the basic tenants of autopoietic theory and apply those to the human body and then see how well Acupuncture theory embodies those principles. In Homeopathy the connection is not so clear but still can be discerned when Homeopathy is seen in its connection to Acupuncture.

There is a science that is more sublime than the crude normative models of Western science that applies to living things and social orders and other anomalous phenomena that cannot be dealt with easily with reductionism. Extreme reductionism makes clear the emergent boundaries between different phenomena at different layers of the scale of emergent phenomena. Once we accept this emergence then we can look at the emergent properties of hyper-complex algebras as a guide to the understanding of the strange twists that are introduced as we move up the scale of emergent special systems that dominate dissipative, autopoietic, and reflexive phenomena.

#### **4. Reflexive Octonionic Special Systems**

Autopoietic systems are closed and homeostatic. As models they do not seem

to apply very well to social phenomena or psychological phenomena that has the fundamental trait of openness to a world. Therefore, we wish to extend the autopoietic model to include this emergent level of phenomena that goes beyond the simple living/cognitive chiasm and opens out another level of chiasmic interdependence between the social and the psychological. At this new emergent level we find that the special systems are not homeostatic but instead what we might call heterodynamic. Plotnitsky calls them heterogeneously interactive and interactively heterogeneous. This brings us to realize that at this level the sharp division between the imaginary hypercycles that control the autopoietic system and the organization of the embodying nodes has been destroyed so that there is a single rhizomatic structure which is variously seen as imaginary and embodying at the same time. This is because the same network of nodes can be seen from different perspectives as inside various individuals and so we recognize it as an essentially substructure that is shared among various individuals of the same socius. Socius is a term introduced by Deleuze and Guattari in *Anti-Oedipus* and *A Thousand Plateaus* when they deny the reality of the individual and instead see people as desiring machines (partial objects) embedded in a social context. From this view the social and the psychological views of things are merged and fused into a single chiasm. The reflexive autopoietic system is the social organism which can be seen as a network of desiring machines in a social context. The individual bodies are merely the carrier of the nodes in this network that together produce the social field. This extremist view shows the meta-systemic viewpoint on the system of the individual. Deleuze and Guattari are taking their extremist stance in opposition to the traditional extreme of identifying people with their bodily individuality as overriding every other influence. A correctly balanced view accepts both the meta-systemic and systemic views as complementary and recognizes that the autopoietic networks that make up the individual organisms are in fact strung together within a social field. This means that a particular desiring machine component may be carried by one individual but used by another within the same social field. This is what makes us complementary and interdependent as social beings. But when we look inside ourselves at our cognitive apparatus we also see that we can model ourselves with the metaphor of the society of the mind<sup>1</sup> Thus when we look within ourselves we see that the autopoietic nodes must cooperate socially to build a whole living/cognitive organism and when we look at individual organisms in their environment we also see that they must cooperate together to live as socially organized groups. Thus the inside and the outside mirror each other. The social is a mirror of the psychological and vice versa. The reflexive special system embodies this mirroring that was implicitly in the autopoietic network.

The autopoietic network that is inwardly distributed socially cooperating cognitive agents and is externally distributed socially cooperating organisms de-couples the mimicry and imagination shadows of action and perception. Through the imagi-

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1. See Minsky *The Society of the Mind*

nation we project our world ecstatically beyond our perceptions to pre-order the world within which the perceptions arise. Through mimicry we allow social organisms to reflect each other and build up norms of behavior in which difference can be tolerated and understood in view of an underlying invisible order. But the key is that out of the de-coupling of imagination and mimicry comes the ability of organisms to resonate simultaneously with each other. At the social level the behaviorists who concentrated on stimulus-response missed the primary phenomena of synchronicity that gives life to the social. Desiring machines do not just float around independently in the field of the socius but instead they form a resonating swarm which allows them to react as if they were a single organism and thus interface with the bodies of the organisms that contain them. The utter lack of this resonance is schizophrenia. So in this we can see that the extremism of the Deleuze and Guattari position which would only look at the schizophrenic of the destroyed social field. Instead we must look at the polyphrenia of cognitive/living creatures that swarm and resonate together as well. In other words we must look at not just the hollowness of existence but its social wholeness as well. Wholeness and Hollowness come from the same root and are opposite sides of the same coin. The social is resonance of the many such that they appear as one. This happens internally within the autopoietic network of the organism and externally within the social field of the individual organisms. In fact the psychological and social are merely mirrors of each other. Psychological imbalances merely mirror distortions in the social field externally and vice versa.

When we think of the reflexive autopoietic special system it is clear that what occurs at this level is that the organization and structural elements of the autopoietic system dissociate. In the autopoietic system the homeostatic feedback loops could either work against each other producing structure or merely effect each other producing flexible organization. At the reflexive level positive feedback loops are added to the mixture that cause divergences from balance. These divergences take us to the edge of chaos. The positive feedback loops may lead either to out of bounds increase or decrease. They must be compensated for by the organizational feedback loops which are no longer merely free to provide flexibility. Instead they must provide counter balance for the positive feedback loops that are added to the autopoietic system at the reflexive level. If too much positive feedback is added either for increase or decrease of some variable then the reflexive autopoietic system self-destructs. But if less positive feedback is added than the limit that can be contained by the organization of the autopoietic system then it can function very far from balance without losing its internal meta-stability. Thus the reflexive autopoietic system can be seen as continuously projecting beyond itself and overflowing itself due to the positive feedback loops within it yet it does not disintegrate because it does not allow any of the positive feedback loops full reign and compensates for their runaway behavior through the in-built organizational flexibility that was only used to re-balance things in the autopoietic system. In the reflexive system the edge far from equilibrium is always pushed to the limit and seems to continually over-spill that limit, yet the special

system continually recovers by transforming itself internally into something new to compensate for the utter transformation of its environment via its own projection of a world upon that environment. The reflexive autopoietic system is continually transforming itself essentially into something different. Thus the autopoietic reflexive system is continually undergoing spurts of emergence. G.H. Mead in The Philosophy of the Present defines the social as emergence. That is to say the social has the unique capability of being able to generate and sustain utter transformation of its essence and the essence of its environment in order to be able to support operation very far from equilibrium. Just as the hole edifice is about to collapse it turns into something else which is essentially different that can sustain that imbalance and turns it into a new kind of balance at a different emergent level. The reason that this is the last level of the emergence of special systems is that it is with the reflexive autopoietic special system that emergence appears. With the appearance of emergence there are endless emergences which continually transform all the levels of the tradition: facts, theories, paradigms, Epistemes and interpretations of Being.

When organization de-couples from structure and the organization takes on the character of periodic emergence at various levels of cognitive organization, then there appear invariants within the world or the cognitive field that would not be visible otherwise. Consider that the reflexive system adds in positive feedback loops that are compensated by the organization of the special system. These positive feedback systems allow variables to run wild and be varied randomly to test their extremes. The whole system compensates for these extreme variations by transforming it from one plane to another within the organization within the special system. But this allows the special system to explore the external constraints on its internal adaptive behavior. Emergences always take place by finding a niche of special organization within a broader set of constraints. Through the addition of compensated positive feedback the organism is able to explore the general constraints of its internal and external environments and find the niches that can be exploited by the creation of emergent properties that exploit that organizational niche. When it inhabits that organizational niche we say that an emergent even has occurred. But the emergent event was prepared for by the creation of mutant attributes that were then varied wildly with positive feedback until an organizational possibility hither to undetected is found and exploited by the continued variation of that attribute and associated attributes that allow the cognitive/living system to change itself essentially to take advantage of those organizational niches. When this happens externally to the species of embodied individuals we call it evolution, i.e. it does simulated annealing. When it happens internally within the cognitive space we call it creativity. In either case what the cognitive/living creature is doing is unmasking invisible invariants and making them visible by taking advantage of them. This unmasking of constraints that are invisible at the social level we call science. At the individual level we call it the exploration of the unconscious cognitive infrastructure. Either way what is occurring is that invisible things are becoming manifest as the living/cognitive creature trans-

forms itself utterly to respond to these invisible invariants that organize the social field. So for instance electromagnetism was invisible until various phenomena that displayed it were organized by a theory. At first that theory separated electricity from magnetism but later a paradigm shift occurred that made theorists realize that these two very different phenomena were two complementary sides of the same thing and they could intertransform. Thus an invisible invariant of our universe, a fundamental force, was made visible and then was able to be put to use to transform the world in many ways by harnessing electromagnetism. Electromagnetism itself is invisible, and only its effects are seen. But by putting all these various phenomena together into a cogent theory we are able to see this invisible force creating a myriad of phenomena in our world which leads to the invention of many devices that harness that force. Thus social cognitive/living creatures have the ability to disclose invisible features of their environment though the transformation of themselves and their environments in essential ways. This is why Plotnitsky uses the phrase heterogeneously interactive and interactively heterogeneous. It implies that the many heterodynamic features of the reflexive system interact to produce an essential expansion of heterogeneity and this new expanded heterogeneity interacts with what was there before to throw it into an hither to unimaginable future which causes it to rewrite the past. The heterogeneity is self interacting and self spawning. It is the essential variety production of the heterodynamic system that informs all living things. And the variety is constantly changing as new kinds of things are constantly being produced which continually changes the context within which each other kind is viewed and its significance, relevance, value and aesthetic charm is measured.

So where a system is a gestalt or showing and hiding structure and a meta-system is a structure that continually hides something that it does not disclose, so to the reflexive autopoietic dissipative special system is a disclosive structure. It discloses invariants that have always been there but were “unthought” by changing the rules of the game in spurts so that the entire space of possible rules is explored. It does not show everything nor does it completely hide anything, instead it strikes a balance in which it shows something but hides something else by itself transforming itself. What it hides is the world it used to project and what it shows is the new world it is not projecting. But in fact everything appears to be still visible but seen from a completely different viewpoint that elucidates it and reveals the hidden invariants that lurked under the surface of phenomena. The social gives a special power to the cognitive apparatus of the living creature that it would not have on its own. That is the power to see invisible things that are constraints on its possible orderings. Because the social autopoietic special system can learn and adapt flexibly to its environment and in fact change both itself and its environment essentially producing genuinely new kinds, it is able to create knowledge which is the most persistent thing and which summarizes the invisible invariants laid bare within the complete flux of an impermanent world. As Durkheim so insightfully remarked Kant’s Categories are social. That means more generally that whatever our categories or highest level concepts are

they are socially constructed in the process of our own essential transformation as we explore all the possibilities within the organizational constraints of our world.

The next level of conjunction beyond the quaternion is the octonion. The octonion is composed of seven imaginary variables that define timestreams and a single real variable. These are different kinds of numbers that only appear different from each other in conjunction. Where it was Hamilton that discovered quaternions it was Graves that went on to discover Octonions (or octaves). Where quaternions are well explored in the mathematical literature there is not much work that has been done on octonions and their associated algebras. At the level of octonions the organization of our reflexive autopoietic dissipative special systems find their analogy. Reflexive level special systems are simultaneously four dissipative systems, two autopoietic systems and one reflexive system. The two quaternionic autopoietic systems are locked together into a marriage in which they are mutually compensating or forming a symbiotic relationship. We can see that the dissipative systems are the model of the desiring machines level and the autopoietic organisms are the embodiment at the level of the individual while the reflexive system embodies the social field (socius) itself. Thus each level of reality of organization within and outside the individual has a form of ultra-efficient organization. The symbol of this ultra-efficient organization at the reflexive level is symbiosis among organisms or marriage contract which is a non-nihilistic social form of organization that gives the basis of the formation of the partial meta-system called the household within the city. Within the reflexive level partial meta-systems are created as the mode of organization. These partial meta-systems or partial systems function as holons standing between the complementary meta-systemic and systematic views of phenomena. Our model of partial meta-systems or partial-systems is the holon that allows us to see something as either part or whole depending on our perspective. The octonion structure gives a mathematical analogy for this structure that is half way between system and meta-system without being either. This is to say that at the reflexive level there is a grounded representation for the holon as simultaneously a partial meta-system and a partial system. It is a meta-system in that it appears as a field containing four dissipative systems distributed among two individual organisms. The field is reflexive and the two dissipative systems are sub-components of the individuals involved in the field. But the fact that we can see the organisms as symbiotic allows us to see that the dissipative systems that make them up can actually interact between them instead of just within the individuals. Thus when there are four dissipative systems present within the field there is created a possibility of six virtual autopoietic systems that cross the boundaries of the organism. At the reflexive system this leads to the possibility of fifteen different virtual reflexive systems made out of the pairwise combination of the six virtual autopoietic systems. We know that there are 480 different representation of the octonions so this means that each virtual reflexive system is composed of at least eight minimal systems of elements if all the possible worlds are to be represented instead of merely the one being projected at the moment. We will call the simultaneous em-

bodiment of all the different possible virtual octonion representations as the Pluriverse and will reserve for the Universe the particular embodied representational configuration that is being existentially embodied or actualized by the social cohort at any one time. The possible universes interact and form the ground of the current universe.

In fact this is an interpretation of quantum phenomena. As David Deutsch remarks, it is possible to resolve the problem of the impact of the observer on observations in quantum physics if we instead consider that whenever quantum indeterminateness occurs then we are witnessing the overdetermination of the phenomena by multiple universes in the pluriverse. These two models are complementary opposites of each other. One projects depth within the observer and the other projects depth outside the universe to account for the undecidability and indistinguishability within the universe. Either way the universe is not allowed to be a system that is rigorously complete and consistent but instead it can also be viewed as an incomplete and inconsistent meta-system. Either the observers have depth that disturbs observations of this indeterminateness or other universes from the pluriverse are disturbing it. Both answers are unacceptable. One leads to the intrusion of the world of logos into the realm of physis which has carefully isolated itself from contamination by subjective consciousness. The other leads to the postulation of innumerable universes being created in any moment by all the quantum events that are decided. But instead of these two scenarios that are nihilistic opposites we can instead realize that there is a grounded balanced alternative to them. That alternative is that there exists a reflexive autopoietic dissipative special system that allows the observers to become symbiotic and allows them to project a single world together through mutual resonance. Thus the creation of the myriad universes of many worlds theory does not take into account the annihilation of these universe. A continual process of creation and annihilation of universes is taking place as part of the social construction of the lived shared world which we project together.

Ben Goertzel describes this process in terms of his Magicians model of chaotic processes. In that model there is a swarm of social organisms called 'magicians' (autopoietic systems that make up a reflexive structure). They are called magicians because like the sorcerer's apprentice they pop into and out of existence according to the socially expressed need by the entire group for them to exist. The magicians mutually interact with each other forming gestalt patterns. One of the patterns is their own organizations so they are autopoietic. Then on the basis of their interaction they nominate which set of magicians should continue to exist in the next living timespan of the swarm. They vote by annihilating each others nominations till the nominees that remain are the candidates for the next embodiment of the swarm. This formalism assumes discontinuity instead of continuity. It allows us to switch between a system and meta-system view of the swarm by adding discontinuities between the life spans of individual incarnations of the swarm. In other words if none of the members of the

swarm exist across the discontinuity between life-cycles of the swarm then there is a meta-system rather than a system. Goertzel's Magician formalism can be used to understand how reflexive special systems solve the problem of the continual resolution of the world from the pluriverse by social interaction. What happens is that in this model the four beginning dissipative systems within the social reflexive field can be seen as a Magician system. These dissipative systems project a shadow of virtual autopoietic systems that transcends their actual embodiment. This explains why we seem to be different people in different social situations yet are able to have enough continuity to be seen as having a unified personality. From these virtual autopoietic systems that are like a ghost haunting the actual embodiment of the organisms which contain their own dissipative systems we get a host of virtual organisms that represent the other possibilities that are not embodied. This host of virtual organisms (fictitious persons) project a penumbra of all the possible worlds that could be embodied as a background against which the actually embodied world is seen. So we imagine as a shadow to our perception of the designated as real world all the other possible worlds. And we mimic as a shadow to our actions in the designated as real world all the actions of the other possible fictitious organisms. The projection of the real world takes place on the background of the possible worlds. That projection is a social project. What happens is the virtual organisms and the virtual worlds in which they live are nominated as possibilities and then annihilated in order to see what organisms will be left in the next instant in what projected and designated as real world. So the many universes are constantly being created but then annihilated again to create the designated as real universe that is socially constructed and agreed upon by the embodied cohort<sup>1</sup>. This social construction includes the mutual action between desiring machines and the gestalt formations including their own organization. That continual projection and annihilation results in a pervasive phenomena of emergence (the creation of new kinds and varieties) which is the hallmark of the social. So many worlds are created and many worlds are annihilated in the chiasm of mutual action and gestalt formation that gives us the world as a universe (i.e. a socially agreed upon and enforced construction). The observers of that world are not just reactive and passive. They are instead projecting the world in resonance with each other. They are not just reacting to stimuli but actually acting in harmony simultaneously together to create and affirm their mutual world. The symbiosis or marriage of the subjects within the world via the special system formation takes them from being passive observers to being proactive participants in their world that they are simultaneously living in and projecting. Thus there is a social phenomenology in which the relation between individuals is more important than the individuals themselves.

Heidegger's 'dasein' is a social group which is not just "with" (mitsein) but are actively interacting to create the world through heterogeneous interactivity and interactive heterogeneousness. They are participating through each other in the mu-

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1. See Desan *Planetary Man*

tual creation of the world such that it is a meta-hologram that is not just holographic in its contents but in the viewpoints on that content. This is to say that it is the very model of interpenetration and can be viewed logically as a hyper-set<sup>1</sup>. This means in this special logic a set can be a member of itself as well. In fact, there is a hyper-power set in which each member of the set contains the whole set each of which is a member of itself. In the view of the world grounded in special systems it is not the observers that contaminate observations of quantum phenomena nor is it that there are infinite universes in the pluriverse that interfere to cause the same effect. Instead there is the social creation of a finite number of possible universes that continually cancel to yield the designated as real universe that is socially constructed by active participants that are symbiotically linked via systematic forms that are analogous to the algebras of the octonions. Physus and logos are non-dual. That means that beyond the duality of physus and logos there is the non-dual realm in which they are the same thing. That realm has its own nomos or order which is mirrored in the two horns of the duality. The worlds and its inhabitants are all non-dual in their perception, actions and thoughts as Loy tells us in Non-duality. Unless we can understand discontinuous processes such as that Goertzel posits with his magicians formalism then we cannot approach the nonduality which underlies phenomena. We glimpse the non-duality when we project chiasms such as those spoken of by John S. Hans in The Play of the World. This vision of Hans is a much more even handed exposition of the non-dualistic philosophy than that given by Deleuze and Guttari. Where they reduce humans to machines and claim that there is no difference at the level of desiring machines, Hans, on the other hand, shows that the it is the Play of the world which allows those machines to become humanized. In the world there is an essential play --latitude -- within the existing constraints that can be explored and occasionally this exploration leads to emergent phenomena. That phenomena allows us to in spurts occasionally change our essence and open up new vistas on the world. In this view the ghost is not “in the machine” but is in fact outside of the machine. The ghost is the shadow of the meta-system that plays across the entire environment exploring all its possibilities for ordering until an essentially new possibility is found and then it inhabits that niche by creating a new kind of ordering that extends our Being in radically new ways and also transforms our environment into something completely different. This exploration can occur because we are heterodynamic -- thrown outside our selves together -- and because we actually organize on the form of the special systems with specific structures at the dissipative, autopoietic, and reflexive levels that interact in conjunction. They do not fuse into one and they do not fall apart because they are ultra-efficient in conjunction. They have a reality on all three levels simultaneously. Psychologically consciousness as described by phenomenologists such as Gurwitsch<sup>2</sup> is seen to be ultra-efficient while the social ultra-efficiency seems to be love<sup>3</sup>. The desiring machines explore the possibilities of virtual organ-

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1. See Aczel *Non-Well-Founded Sets*

2. See Aron Gurwitsch *The Field of Consciousness*

isms, the organisms explore the possibilities of virtual worlds, and the world continually collapses these worlds into a single socially constructed and embodied world through the annihilation of the possible worlds and the possible organisms of the nominated set to bridge the discontinuity into the next life-cycle of the swarm.

At this level one of the important algebraic properties is lost: associativeness. We lost the commutative property at the quaternion algebraic level and now we lose another fundamental algebraic property which in turn gives these reflexive systems their special characteristics. Loss of algebraic properties drives the manifestation of the characteristics of each emergent level of the special systems. When we lost the commutative property mutual action appeared as the special property of these systems. Now when we lose the associative property we see the social aspects of these systems emerge and become prominent in their manifestation. When you cannot easily reverse actions but must take circuitous routes back to a state prior to some simple action then actions become prominent in the analysis of systems without the commutative property. Likewise when you cannot reverse associations at will then those associations become very important characteristics of the special systems under study. Different associations have different organizational properties that are unique they do not vanish under symmetry operations in this algebraic system. So we realize that the highest possible alternating division algebra (the octonions, as there is no other alternating division algebra beyond it) emphasizes the social properties of systems. What is the social but the relations of association between autopoietic systems? So we find that octonion systems have very special emergent characteristics due to the loss of a vital algebraic property. And those special characteristic are social. As G.H. Mead has shown us the social is defined by the presence of emergence and the ability of the social to cope with emergences. Once the ability to respond to and generate emergences has appeared then there is the possibility for the generation of endless variety of emergent levels and phenomena. So our definition of the special systems end where the endless sea of variety due to the actualization of emergence begins.

The meta-systemic operation at this level is pattern formation. Pattern formation appears in the association of elements within a gestalt. But here the pattern is the pattern of the pattern-er. That is to say the autopoietic system which organizes itself can take on many patterns which it actualizes as new patterns constantly emerge within it. At the reflexive level there is a meta-patterning organization that is the source of a myriad of patterns that are actualized. We have already mentioned the Magician systems of Ben Goertzel. In those systems there are operators that correspond to each of the levels of special system organization. The first operator is the annihilation operator. It is the dual of the creation operator that emerges from the real algebra that produces systems on the background of complete ordering. When the imaginary numbers arise it is a dual numbering system that can annihilate with the

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3. See Statler *Existence and Love*

real numbers if the conjunction that holds them together yet apart is broken. Then the mutual action operator of Magician systems arises when the commutative property is lost and actions cannot be merely reversed to get back to the original state. This is a symmetry breaking at the level of behavior of the system. This symmetry breaking occurs based on the prior symmetry breaking that gives annihilation and creation as opposite fundamental operations upon the field of illusory continuity (the real number timestream). A further symmetry breaking occurs as we move from the level of quaternion to the level of octonion algebras and their associated special systems. At that level associations are no longer symmetrical and so social relations become important. At that level too we can create unique patterns within the same gestalt formation. What we quickly realize is that what has mutual actions form together a single pattern as well. So by the mutual actions we are creating the organization of the patterning. This is the very definition of the autopoietic system but raised to another level at which the system is patterning itself ever anew through cooperative action. At the reflexive level it is the cooperation and communication between the nodes of the autopoietic network that is emphasized. The network is no longer seen just in the context of a single organism but is seen in the context of the systems of related organisms that together inform each others organization. For that to occur each organism must go beyond itself and project the organization of it's other. The self and the other then mirror each other. This mutual mirroring based on mutual action is Reflexion. In a reflex something reacts back on itself. In this case it reacts back on itself via the mirroring of the other in it and it in the other. Autopoietic networks whether in organisms or between organisms must be social in nature. The inward and outward reflexive nodes mirror each other so the social and psychological become chiasmic duels at this level of organization.

The reflexive system is a chiasm of social/psychic properties. The social ~~IS~~ the psychological and vice versa. Here the strike out of the IS indicates Differance in the sense of Derrida which means the reflection in the mirror is distorted by differing and deferring. The mirroring at the reflexive level is distorted and that distortion is what allows social entities to be the same yet different. This distortion appears as the effects of the loss of the associative property within the octonion algebra. It produces similitude as multiple associations can be very similar yet still be different as one attempts to reverse via chains of associations another association that has no symmetrical opposite. This produces endless variety in the mirroring similar to the endless variety at the level of actions produced by the loss of the commutative property. This is also what gives the social and the psychological sciences their uniqueness. In both science context is everything. The sets of associations between elements determines their unique characteristics and produces emergent effects that cannot be simply mapped form one individual or social situation to the next. The social and the psychological are two sides of the same coin. Social relations produce differing psychological responses and the chemistry of particular people will produce a particular unique quality to social relations. The uniqueness of one generates the uniqueness of

the other and vice versa in an indefinite mirroring that just does not appear at the simply autopoietic level of the organism considered alone.

[Integra?]

## 5. Duality and the Kinds of Being

The reflexive appears to us in terms of a series of levels of learning when we see it in terms of logos and a series of levels of change when we see it in terms of physus. We can see these levels of learning or change as Bateson did as being truncated at four levels. So we see that a fifth level is unthinkable if we follow his analysis in Steps to the Ecology to the Mind. But what this reveals is that knowledge appears at the reflexive level. And the strange thing about knowledge is its persistence. Knowledge is the most persistent thing in existence. We build our world out of its persistence. In the autopoietic system cognition and living are mixed. Thus there is no separation knowledge out from the tacit understanding of the organism of its environs. But at the reflexive level knowledge appears as what persists among the changing patterns of experience. Once knowledge appears we can rise to meta-level after meta-level in our ability to deal effectively with knowledge. We learn, then learn to learn, then learn to learn to learn, and finally learn to learn to learn to learn in the face of change, change of change, change of change of change, and change of change of change of change. But we hit a blank wall if we try to comprehend learning or changing at the fifth meta-level. This lack of comprehension beyond the fourth meta-level of learning/change gives brings us right up against the ultimate groundlessness of all our knowledge that was pointed out by Hume. We interpret that groundlessness to be identical with the Buddhist concept of Emptiness (Sunyata). And we see in the meta-levels of learning the premonition of the phenomena of the fragmentation of Being. Being appears in four kinds and when we cease to split physus from logos we are faced with the fact that there are different ways that any entity that essences forth a world can relate to that world. The ways of essencing forth the world are equivalent to the projection ideation within a world. So we see that ideation that arises in the production of persistent knowledge has a substrate that produces the illusory continuity. That substrate breaks up into four kinds of Being or ways in which being-in-the-world can be actualized.

At the reflexive level then we find that the chiasm between learning and change appears as the difference between the most persistent thing (knowledge) and the most fleeting of things (the flux of experience). But this appearance of the epistemic goes hand in hand with the arising of ideation that reveals the substrate of the illusory continuity that supports the ideas. Ideation appears on the basis of the four kinds of Being as ways of relating to the world. Strangely enough these kinds of Being relate to each other via quaternionic as well as meta-level relations.

The levels of Being are these:

*Figure 8:*

- Pure Presence -- present-at-hand
- Process Being -- ready-to-hand
- Hyper Being -- in-hand
- Wild Being -- out-of-hand

Pure presence is the traditional kind of Being described by Aristotle, Descartes, Kant and most of the philosophical tradition. Process Being was discovered by Husserl and first made the basis of a philosophy by Heidegger in Being and Time. Once different modes of being-in-the-world were discovered to exist then the question was how many were there. Merleau-Ponty first discovered Hyper Being in Phenomenology of Perception. It was rediscovered by Heidegger and called Being (crossed out) which was subsequently made a center of a philosophy by Derrida who called it DifferAnce. Wild Being was discovered by Merleau-Ponty in his The Visible and the Invisible. It was first made the center of a philosophy by Deleuze and Guattari in their Anti-Oedipus and A Thousand Plateaus. It was explored by Loy in Non-Duality under the rubric of Asian Philosophies relation to Western philosophy and by John S. Hans in The Play of the World. Recently Arkady Plotnitsky has made headway deepening our understanding of this philosophical meta-level in his works Complementarity, Reconfigurations and In the Shadow of Hegel. All of these meta-levels of Being have been explored to various degrees during this century in which the fragmentation of Being has occurred. But what is not generally realized is that these different kinds of Being work together to form the substrate of ideation and that they are revealed beyond the veil of our projection of the dualism of physis and logos when we consider the ontological groundings of our knowledge and its connection to the world through our very being-in-that-world.

*Figure 9:*

[Hetero/homeo static/dynamic]

[special systems vs kinds of being]

An genuine emergent event must traverse all four of the meta-levels of Being in the process of its manifestation within the world. This is because an emergent event is a particular integral synthesis of these four different kinds of Being. The emergent event embodies its own stages of coming into Being in its very structure. These stages relate to the different modalities of our being-in-the-world. Only the emergent event can decenter the whole world and cause a transition to a new world

complete with a new future and a new past. The emergent event relates to our whole being because through it our human essence is transformed. The appearance of genuinely new things in the world changes who we are as well as the world and our relationship to it. It is our essence as 'dasein' to ecstatically project the world. We can relate to every thing within the world through the four kinds of Being. Emergent events integrate all our ways of relating to the world and decenter our world changing both the projector and what is projected. Emergent events can either arise from within us as our creativity or outside us as brand new phenomena that are seen for the first time. The direction of the emergent event is not relevant. What is relevant is that it not only transmutes our world by displacing all the diacritical relations between things but also it transmutes us because it changes who we are fundamentally. We 'are' the ones who have projected the new world that contains the new emergent eventuality. We are the ones that have released one world and grabbed onto another one and in the process took an unexpected tact that changed both the future and the past in one fell swoop.

At the reflexive octonionic special system level this possibility of emergence appears as the confluence of the possibility of both creation and annihilation established at the level of the real and complex numbers and the systems that can be expressed via analogies with their algebras. But also in the confluence between the loss of associative and commutative properties. The Magician systems described by Görtzel have the property of synthesizing the different kinds of Being in a single model. From that we learn that the loss of commutative property produces the emergent characteristic of mutual action in Magician systems. And the loss of the associative properties produces the emergent characteristic of gestalt patterns which is essentially the production of social patterns. In an emergent event there is the creation of one world and the destruction of another world. Each of these worlds are characterized by the mutual actions of things and the gestalt formation of patterns. There is an inner transmutation of the patterns and behavioral complexes in the jump from one world to another. The jump from the old world with its past and future to the new world with a different past and future is a process that ends up shifting from one Purely Present regime of manifestation to another. This jump is a discontinuity and thus has the essential nature of Hyper Being. But in the jump itself there is a wild and chaotic point of departure into an unexpected turn of events and a counter intuitive state of affairs. Thus the different kinds of Being do not just describe ideation but the transformational effects of ideation which adapt to the utterly new and completely unheard of and totally surprising aspects of existence. All this appears under the rubric of the reflexive that produces the social substrata (what Deleuze and Guattari call the *socius*). The reflexive brings the social into existence and this last key element makes it possible for emergence to appear which reveals the inner coherence of ideation and makes the kinds of Being visible beyond the hierarchy of the meta-levels of change/learning.

## 6. Recursive Sedenion Meta-Systems

Each of the special systems can be seen as a partial meta-system. When the series of alternating division algebras end then we graduate into the pure meta-system where linearity gives way to circularity by the loss of the division property. That loss of the division property causes the emergent properties of interpenetration to arise within the meta-system. The meta-system is a field of complementarities of complementarities ad infinitum and is represented by the various non-division algebras that may be created by applying the Cayley-Dickson process iteratively ad infinitum. This results in the embodiment of Pascal's triangle by algebraic objects like the imaginary numbers in successive progressive bisections or projections. But these higher structures lack the properties we consider interesting in algebra. But that very lack makes them perfect for modeling interpenetration. The obverse of a lack of division is 'fusion' and that is what interpenetration signifies. The Sedenion may be seen as the multiplication of octonions. These octonions are non-associative but continue to support the possibility of division within themselves. But this property vanishes within the overall structure of the Sedenion. The Sedenion contains fifteen virtual octonions that are the shadows of the two conjuncted octonions that gives rise to the Sedenion. Of these fifteen octonions three are special. Those three represent ultra-efficient worlds where showing and hiding (i.e. Manifestation of Being) vanishes. Those worlds merely exist. Existence is the absence of showing or hiding relations. The twelve other worlds, and each octonion may be seen as a possible world, all have showing and hiding structures in which when you show some aspect of the world then another aspect vanishes. Thus the twelve other worlds represent the shadow of the ultra-efficient worlds. And those ultra-efficient worlds represent the inside of the quaternion structure. In other words, the closed quaternion formation which shows us how every part can contain the whole still remains closed. But at the Sedenion level we discover three special worlds that have a special relation to each other that allows us to see inside the quaternion and see that each quaternion formation contains three parts that are themselves whole worlds. Thus at the Sedenion level arises the crucial difference between enlightenment and non-enlightenment. Here we think of enlightenment as the embodiment of social 'flow' within a society. Social flow being the analog to psychological flow within consciousness. That experience of psychological flow is how we experience ultra-efficiency within consciousness. So too, it is experienced in society by the embodiment of social flow that we see whenever a team 'clicks' on a project. Social flow takes us into the ultra-efficient worlds. These are the worlds of existence (non-showing and non-hiding) and away from the showing and hiding of the twelve worlds of normal efficiency. These worlds show up in myth as the time of Kronos and in many other forms throughout world mythology where the world takes on an ultra-efficient modality. The time of Kronos was the golden age when toil was not necessary. That age is actually a possibility for every world. It is possible for us to snap into a world of social flow in which there are ultra-efficiencies that do not just effect special systems within the

world but in which the whole world is a special system. In that world Being in all its kinds vanishes because neither showing nor hiding no longer occur in the same way and instead all that exists is that which is neither shown nor hidden which the Buddhists called Thusness or Suchness. So Leibniz was right there is a best of all possible worlds, but it has no Being or Manifestation. Thus the world we live in that manifests is not it. What he was wrong about was that there was only one best of all possible worlds. There are in fact at the Sedenion only fifteen possible worlds and three of them are 'best' in the sense of ultra-efficiency and lack of showing and hiding or unadulterated existence.

Social Phenomenology starts from the premise that the social comes before all other experiences. And within the social it is the experience of social flow that is the sine quo non of all social experience. This is the experience of pure resonance and synchronicity between the members of the socius. This experience was called the fused group by Sartre in The Critique of Dialectical Reason and the Pack by Elias Canetti in Crowds and Power. This fundamental experience of communal consciousness in perfect rapport is supported by the mathematics of the Sedenion which singles out three octonions as different from the other twelve. Those octonions correspond to reflexive worlds among the special systems. Those particular reflexive worlds can be fully engulfed by synchronicity in which the showing and hiding of Being vanishes. This can happen to whole groups as Sartre and Canetti describe. We may describe the Sedenion as a mirrorhouse of mirrorhouses. Within the meta-mirrorhouse there are subtle breaks between the octonions where the division property breaks down so that there is a fusion of the plural worlds with each other. As we go on from the sedinion which has sixteen imaginaries to the 32-nion, 64-nion, 128-nion we see worlds within worlds that we would expect in the pluriverse. These worlds are fused and at the same time separate as they exist in Indra's net of interpenetration. Interpenetration hides behind the complementarity of dualities within the meta-system. Duality points toward the inexpressible non-dual state beyond the complementarity that cannot be known and ultimately does not have any Being due to its intrinsic emptiness. Emptiness is the flip side of interpenetration. Because each thing is empty it can thus interpenetrate with all other things. Emptiness is the true nature of existence. What is not shown or hidden is the emptiness of the things. What cannot be shown nor hidden is the interpenetration of all things. Enlightenment in the Buddhist sense is the realization that there is no difference between enlightenment and non-enlightenment, just as there is no difference between ultra-efficient worlds and normal worlds at the octonion level but this distinction arises only within the context of the Sedenion. There are worlds within worlds within worlds as we follow Pascals triangle in the iteration of the Cayley-Dickson process of unfolding of each new level of imaginary complexity. Indra's net is vast. But within it is the possibility of local continuities and those appear as the special systems within worlds and at the level of the world there is the three special worlds that are ultra-efficient. We call these worlds within worlds within worlds and take this as the key emergent at the level of

the Sedenion. Reflexive systems form the mirror house by reflecting distorted multiple mirrors. At the recursive level there is the opening to discontinuity that is given by the break in the linearity of the imaginary timestreams. This gives us cyclical time. These cycles are called in Buddhism the wheel of Samsara or Birth and Death. As discontinuities open up across time instead of between time streams we look through them directly at the emptiness beyond the imaginary continuities that we project on existence that gives the illusion of persistence or Being.

## 7. Ultra-Efficient Special Systems

The key feature of the special systems is their ultra-efficiency. This is to say that they unexpectedly bring four dimensional rotations into the three dimensional realm and violate our expectations by giving us the equivalent to perpetual motion machines that we normally think of as impossible but which are indeed actualized either physically or logically. Within four dimensional higher dimensional space it is well known that perpetual motion is a possibility because rotations blocked in four dimensional mechanical devices are possible in that realm. And, of course, we know that we live in a four dimensional spacetime realm but we normally relate to it via our concepts of three dimensional space segregated from time. But what the special systems make clear is that nested within our three dimensional projections we can on a rare occasion access the implicit four dimensionality of the underlying spacetime substrate. When this occurs then we get phenomena that violate our general rules as to how things work. But these violations that appear as anomalies are just as real as the norms we project upon existence. It is in the deep nesting of phenomena that the four dimensional rotations appear that give rise to unexpected ultra-efficiencies. The discovery of these ultra-efficiencies is always an emergent event within the realm of normal science that leads to revolutionary paradigm changes.

Two examples of such ultra-efficiencies that violate our expectations are solitons and super-conductivity. One of these is a macro-phenomena of unique waves propagating in channels while the other is a micro-phenomena of electrical conductivity in a lattice of particular types of molecules that only appears close to absolute zero but recently have been found also in or about the freezing point of nitrogen. In both cases there is a special circumstance that produces the unexpected ultra-efficiency and the study of these special circumstances lead to a major refinement of our understanding of the forces of nature. Soliton solutions have been found in many basic physical equations, like the Schroninger Equation, and many different kinds of chemical compounds are found to have super-conductive properties. Both of these phenomena are ultra-efficient but this ultra-efficiency has not been related to any general theory. The theory of the special systems now claims to be the underlying general theory of ultra-efficiency. It describes how four dimensional rotations enter into systems and introduce a nesting that allows an access to the underlying four dimensional substrate beneath our projection of three dimensional spatial constructs on

existence. This access to the underlying four dimensionality is gained by the bifurcation of the timestreams within the system so that the conjunction of the different timestreams produces the ultra-efficient effects that we see in our experiments. In each case the underlying mechanism will be different. For super-conductivity it is the arising of Cooper pairs that communicate via phonons which is the vibrations of the lattice of atoms they are traveling through. In the case of solitons it is the reflections of the solitary wave off the bottom of the channel through which they are traveling. But in each case the ultra-efficiency arises from a synthesis of the different kinds of Being as represented in a particular configuration of the logos / physis dichotomy as it is applied to particular phenomena. This means that in every case of ultra-efficiency there is a mapping between the phenomena one of the ultra-efficient special systems that have analogies with the hyper-complex algebras. The mapping of super-conductivity is to the autopoietic special system where the Cooper pairs act like a closed pair of dissipative systems. In the case of the soliton the mapping is to the dissipative system where the reflection of the wave form off the channel gives an Escher waterfall like effect in which the reflected energy of the wave out is used to keep the wave going beyond what we might expect. And example at the reflexive level is the ultra-efficiency in the system of minimal methods for Software and Systems Design which allows all the viewpoints that are normally separated to be integrated into a single representation at the reflexive special systems level.

The discovery of a general theory of ultra-efficient systems is a major advance in General Systems Theory which now covers the special cases of formation/patterning, living/cognitive and social/psychological effects. Now sociology and psychology can be grounded in a particular form of mathematical analogy which will allow them to be systematized in a way analogous to the systematization of the other sciences. Other sciences take great advantage of mathematical analogies to advance their understanding of phenomena. Now both sociology and psychology can follow this same royal road of science but applying analogies to parts of mathematics that physicists have not been able to apply very well. It is of interest that quaternions and octonions have found little use in describing physical phenomena. But now we can see that they have their use in describing the articulation of the Logos into its social and psychological aspects.

Also until now autopoietic theory has been a backwater of the theory of living and cognitive systems. It describes well the anomalies of these kinds of systems but as a theory has not been well excepted because the theory did not seem to have any mathematical grounding. The realization that quaternions are the mathematical grounding of autopoietic theory will go a long ways toward the production of grounded representations that will allow us to build better models of autopoietic systems. And we will no longer apply this theory haphazardly to social systems because we know that we need to advance to the next emergent level in order to describe social and psychological phenomena which unfold from and are based on the con-

straints of the living and cognitive autopoietic systems. Finally we realize that the autopoietic systems are built out of dissipative systems and so there is a bridge to normal non-dissipative physical phenomena. So it is now easy to understand the steps by which the emergent living system must go through to evolve out of non-dissipative phenomena.

The theory of ultra-efficient phenomena unifies the field of studies that have been so long dualistically separated. The physical phenomena have been described quantitatively with great rigor until it hit the wall of quantum mechanics that set the limits to application determinateness. The logos has been described mostly in qualitative terms through the humanistic disciplines such as hermeneutics, phenomenology, dialectics and structuralism. But now we realize that the realm of logos has its own special systems and these have a direct connection to all other systems through a certain series of emergent levels. The special systems and their emergent levels in connection with the general theory of systems ties logos and physis into a single mathematically described structure which then allows us to see beyond that structure to the levels of Being that unify our projection of the world and all the ramifications of the logos/physis dichotomy within our world.

## 8. Holonomics

But the access to the key characteristic of ultra-efficiency is not the only thing that the theory of the special systems give us. It also gives us a clear view of what Holonomics really means. That is Holonomics applies to the conjunction of different timestreams and the splitting of the real number lines that are fully ordered and represent illusory continuity in our description and measurement of systems. When the single timestream bifurcates it goes through a series of symmetry breakings that each has profound consequences for the intertransformation of descriptions of systems. With each emergent algebraic level certain key characteristics change and new ones are introduced so that there is a transmutation of the basic constraints that our attempts of intertransformation must operate under. This means that unexpected four dimensional effects enter into the nesting of our systems as they split into multiple timestreams that are described by hyper-complex algebras. So nested within our general systems described by Klir's general systems theory are special systems descriptions that are radically different and non-intuitive but which manifest as physical or logically discriminated phenomena. Through these phenomena we discover the synthesis of the kinds of Being and have access to the structure and unfolding of the emergent event.

Holons special meso-systems that arise between systems (gestalts) and meta-systems (origins and arenas) which have parts that are held in conjunction and which exist in relation to separate timestreams that are also in conjunction. These strange wholes are exactly equal to the sum of their parts, neither more (like the system) nor

less (like the meta-system). Holons are neither part nor whole but are at the same time both part and whole in a strangely beautiful perfect balance. Their analogy are the perfect numbers whose parts add up to the whole without remainder nor deficiency. Holons act like Wholes from one point of view and parts from another point of view so they fulfill the original Janus faced characteristics of things that can be seen as wholes or parts depending on the viewpoint on them.

Having mathematical analogies for these strange special systems is a very important advance because it gives us an access to the nomos that lies behind both the physis and logos. It gives some grounding to our understanding of the counter intuitive properties of dissipative, autopoietic, and reflexive systems based on derivations from the mathematical properties of the algebras. And extensive explorations of these implications show that the counter intuitive analogies with the algebras are very revealing as to the nature and logic underlying the special systems at all three emergent levels. This gives a mathematical grounding to the general theory of holons, so we can now speak of a science directed at discovering ultra-efficient special systems based on a general theory of such systems which explores the nomos that underlies conjunctive holons. So finally after many false starts a new mathematically grounded science of holonomics is born which is directly connected to general systems theory and explicitly defines a series of emergent levels that define strange special systems that defy our expectations based on the norm of thermodynamic entropy. This norm is rarely but still definitely broken by specific phenomena in nature. Now we have a basis for tying these phenomenal anomalies together and a hypothetical pattern to assist us in discovering new ones. And in fact the application of this pattern to design methodologies led to the discovery of the ultra-efficiency in that arena which will be reported in a separate article.

## 9. Discovery

The discovery of the special systems is an excellent example of serendipity. It resulted from the collision of two completely separate lines of investigation with an Aha! realization that these two divergent strands were intrinsically related. It occurred in the summer of 1993 at a time when I was studying the application of George Klir's General Systems Theory to the processes that underlay the use of methodologies in software design. These studies had always gone on in a broad philosophical context and I was engaged in attempting to redefine General Systems Theory in relation to the methodological distinctions that Klir discusses in his Architecture of Systems Problem Solving. The lattice of methodological distinctions that were intimately connected to the viewpoints on real-time design ended in the creation of the reals as the model of illusory continuity upon the background of which dynamical systems were described and measured. On the other hand for a long time I had been studying Chinese Traditional sciences such as acupuncture and was using the bifurcation of hyper-complex algebras as a model of those autopoietic systems.

One day I realized that the hyper-complex algebras began in the reals and the lattice of methodological distinction ended in the reals. So I wondered what would happen if I connected these two very different structures together in the same model. This effectively created a bridge between General Systems Theory construed in terms of orderings and the models of autopoietic systems that I had developed separately based on Hyper-complex algebras. The combined structure had a lot of implications that I am still exploring. The stages of the development of these ideas are recorded in two series of working papers called On the Social Construction of Emergent Worlds and Steps to the Threshold of the Social. The papers were concentrated on the implications of the extension of the autopoietic theory into the social based on the analogies to the hyper-complex algebras. However, they cover the entire structure and its derivation and philosophical grounding with extensive work on the implications of Magician systems. These papers attempt to found the new disciplines of Autopoietic Sociology and Computational Sociology as well as ground a new Social Phenomenology. But the discovery of the general theory of ultra-efficient special systems applies to many different fields which have been haunted by their lack of scientific basis due to the fact that what they describe and explain follows strange hard to capture rules which do not seem to fit normal physical models. When the subject of these other sciences have some aspect which is ultra-efficient in some sense then a study of the implications of the general theory of ultra-efficient phenomena should be made to see if these mathematical analogies that have been discovered to apply to the special systems also describe aspects of these other phenomena. There are many phenomena that probably fit under the rubric of ultra-efficiency and the special systems that have not been recognized because of their violation of physical laws and norms. This new science of Holonomics recognizes that there are rare exceptions to the norm that must be studied separately and that these anomalies in various fields have functors between them that are mediated by the theory of the special systems.

## 10. Acknowledgments

I would like to acknowledge first the help of my teacher and mentor Ian Dallas, who set me on the route that led to this discovery. I would also like to acknowledge the contribution of Onar Aam who contributed an intimate knowledge of the workings of the algebras and many useful insights that has extended the theory in many unexpected ways. Also Ben Goertzel who inspired much of the theoretical work that led to the formulation of the implications of the relation between the algebras and special systems. His model of the Magician system helped to supply a crucial link in the puzzle that I was struggling to put together. Thanks also goes to Leonard Woo who was working with me at the time of the major discoveries and supplied their initial reality check. Tony (Frank) Smith also contributed much to our understanding of the structure of the Octonions and their implications for the unification theory in physics. Also thanks goes to Bob Cummings who read the working

papers and contributed many hours of fascinating conversation about the implications of the discovery. There are also many others who participate in the Thinknet philosophy and systems theory email lists that deserve some credit through many computer mediated conversations over the last few years. Among those lists is the `autopoiesis@think.net` list where Onar Aam and I met originally.

To find out more about those lists send the message HELP to `list-serv@think.net` or have a look at the DialogNet homepage at URL `http://server.snni.com:80/~palmer/dialognet.html`. The DialogNet Web-BBS is available for telnet at the address `dialog.net`. The working papers mentioned above are available from the author. You can also reach me at `palmer@think.net`, `palmer@netcom.com`, and `palmer@exo.com`.

If you discover any ultra-efficient phenomena using this theory as guidance please contact me, as I am collecting examples of phenomena that have functors to structural aspects of the theory.

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**Apeiron Press**

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Orange, California 92856  
714-633-9508

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## Reflexive Autopoietic Systems Theory

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

### Library of Congress Cataloging in Publication Data

Palmer, Kent Duane

Reflexive Autopoietic Systems Theory

Exploring the Meta-systems of Emergent Worlds

Bibliography  
Includes Index

1. Philosophy-- Ontology
2. Philosophy - Worlds
3. Systems Theory -- Meta Systems Theory

I. Title

[XXX000.X00 199x]  
93-xxxxx  
ISBN 0-xxx-xxxxx-x

### Keywords:

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