

Steps to the Threshold of the Social

Part 2: General and Special Systems Theories: Form, Pattern, Traces and Magician Systems.

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1. Abstract

This paper develops a theory of what Ben Goertzel's Magician Systems are in relation to General Systems Theory such as that of George Klir. It explores the complementary nature of Form and Pattern and shows that another key concept of Trace as defined by Jacques Derrida is needed to understand their duality. It lays the ground work for understanding the intimate relation between Magician systems defined in algebraic terms and the different levels of special systems: dissipative, autopoietic and reflexive.

2. Keywords

General Systems Theory, Autopoietic Systems, Dissipative Systems, Social Systems, Ontology, Algebras, Complex Numbers, Quaternions, Octonions (Octaves), Psychology, Sociology, Social Theory, Computational Theory.

3. Acknowledgments

Besides those mentioned in the acknowledgments of Part One I would like to thank Louis Kauffman for his explanation of several aspects of the Laws of Form and his advances of that discipline.

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Draft#2 940906; Total pages: 725; Date of this copy: Thursday, April 16, 1998;
File name: stts2v03.doc

4. Stages of the Unfolding of General Systems Theory and Beyond

In this series of essays we take the General Systems Problem Solver of George Klir as the epitome of structural General Systems Theory (GST). And we shall assume familiarity with that formulation as expressed in Architecture Of Systems Problem Solving. That formulation and some of its philosophical implications has been explored in detail in previous papers by the author. Here we are interested in contrasting the GST of Klir with an alternative formulation first presented in On The Social Construction Of Emergent Worlds¹. That alternative formulation makes use of the concept of Methodological Distinctions which is set forth by Klir. A methodological distinction is the kind of ordering that a variable can have within a system model. It has been discovered by the author that methodological distinctions have deep implications for our modeling of real-time dynamic systems as reflected in software design representations. In this first section we will build up an alternative formulation of GST based on the implications of methodological distinctions. In this we note that methodological distinctions are not just a random fact about variables that limit our models of dynamic systems. Instead methodological distinctions can be seen as the layers of any general theory of systems. This causes us to build up our systems theory in these layers².

4.1. Stage One

The first methodological distinction is “no order” which means the appearance of pure unordered distinctions. We associate this with Peirce’s category of Firstness. Each distinction is independent of all other distinctions and utterly without any ordering in relation to them. This is the substratum for all our descriptions of systems. The least possible model we can have of a dynamical system is a set of independent distinctions applied to it in some wily-nily fashion where the individual distinctions are not mutually interrelated.

We note that requirements for any system we might design have this kind of presencing. Requirements remain always unordered in relation to each other. They are like axioms or aphorisms which are independent statements. Try as we might to order them requirements resist ordering. Thus the unordered set of distinctions that are described by requirements represent a fundamental viewpoint on the system

1.Unpublished series of papers by the author.

2.See the second paper in the On The Social Construction of Emergent Worlds series for a fuller explication of these stages.

which does not go away or change with the addition of other layers of methodological distinctions. Any system we might describe will have Firsts, i.e. what presences independently as “hyle.” Ideally these Firsts are orthogonal to each other, that is perfectly independent.

This is the first stage in the emergence of a dynamical system. In this stage we know something is there, is presencing but do not know what it is. Firsts on their own, paradoxically, cannot really be seen. They are the ideal of pure sensations. But when Firsts are present we know something is there, we just cannot say what it is. Thus Firstness is the manifestation of Thusness or Suchness as Thingness.

4.2. Stage Two

At the next stage the methodological distinction of partial ordering is introduced. Partial ordering allows indeterminacy to operate between Firsts. This layer manifests with the introduction of two new viewpoints: Agent and Function. These viewpoints allow us to view the dynamical system in relation to the principles of autonomy and intentionality. These viewpoints cannot achieve more than a partially ordering. They are duals of each other. Under their auspices Seconds in C.S. Peirce’s sense are produced. Seconds are relations between Firsts. The most primitive relations possible are partial orderings. They are relations that do not fix the relata but instead leave the relata in indeterminate connections with each other. However the viewpoints themselves are Thirds because they go beyond the relations given to give them significance. Thirds are significances that spill over beyond relations to give a unifying perspective to things.

This is the second stage of the emergence of a dynamical system. In this stage we know not just that something is there but that it is indeterminate in relation with other things that are there. It is This *or* That. It is Here *or* There. But exactly which or where is not known.

4.3. Stage Three

At the next stage the methodological distinctions of Linear Order without Distance or Partial Order with Distance arise. These dual methodological distinctions do not represent a viewpoint but instead represent the interaction of the Function and Agent viewpoints. Two partial distinctions can interact in two ways to form these two possible methodological distinctions. The duality of these distinctions appear again as the duality of minimal methods for the representation of dynamic real-time

systems. The duality here produces a “space” within the system itself which makes possible what B. Fuller calls synergy. Building on Peirce’s categories we might call this a Fourth. When we design a real-time system parts must play multiple roles. This inter-embedding of parts which play multiple roles is synergy or Fourthness. Because Peirce only uses Logic as his basis for developing his categories he does not recognize Fourthness. However, in Geometrical examples it is clearly something beyond the overabundance of significance produced by Thirds. Fourthness or synergy arises in the interspace between the dual minimal methods by which the interembedded design is created. Between the dual orders appears a “space” within which there are folds that allow things to have multiple functions that overlap.

At this level of presencing the dynamical system appears as a schematic design. This design appears as slices of a turing machine that describes different aspects of the system.

4.4. Stage Four

The final stage of manifestation of the system in terms of layers of methodological distinctions gives us full ordering which we are normally used to using to describe dynamical systems. This full ordering allows us to see the system in terms of what Peirce calls Seconds or full relations between Firsts. There is a combinatorial explosion of possible relations between firsts. This is also the point where actual presencing occurs. At this stage the illusory continuity which we assume glues the system together appears.

This is the level at which full presencing as an illusory continuity appears. Illusory continuity means that the 30 frames per second repetition with difference is achieved so that the system appears before us as a dynamical continuity like a movie. This illusory continuity is a simulation of the dynamical system which is indistinguishable from “reality.” At this level the real number line exists as the standard for judging the fidelity of the simulation to the designated as real referent.

Most forms of GST attempt to model phenomena at this level. Most of these approaches gloss over the other layers of methodological distinctions. Klir at least mentions them but does not see them as fundamental. In this presentation we see the layers of methodological distinctions as fundamental layers by which our model of the dynamical system is built up. They are in effect layers of manifestation of the system in our simulations of it and thus take on an ontological significance.

4.5. Stage Five

From the methodological layers of manifestation we move on to the special systems theories that equate with different peculiar systems. At the next stage complex numbers augment the real numbers while retaining the algebra of the real numbers merely extending it to cover pairs of numbers of different but indistinguishable kinds. This stage is analogous to the dissipative system as posited in Part One of this series of essays.

4.6. Stage Six

The next highest set of kinds of numbers are the quaternions and their associated Clifford algebras. These are analogous to the autopoietic living/cognitive systems which are an even more specialized kind of system emanating from GST.

4.7. Stage Seven

The highest set of kinds of numbers that exist are octaves (octonions) and their associated Cayley algebras. These are analogous to the social reflexive systems which are the most specialized kind of system that emanates from GST.

Each of these stages represent an emergent level of manifestation of systems. The analogies between numbers and systems or layers of GST give us an important framework for analyzing the phenomena that appear at each of these levels. This series of essays are dedicated to analyzing these phenomena from the point of view of these mathematical models. This essay will focus of the GST layers from which the other systems theories emanate. The stages appear from out of the void where firsts appear from nowhere. They return to the void as fragmentation enters our numbers and their algebras. But between these two interfaces with the void there is a definite structure to manifestation of our simulations based on the inherent structure of numbers and their strange relations dictated by our desire for continuity in the face of the strong presence of discontinuities fragmenting everything.

The value of this hierarchy of stages is that we can see that GST is not the monolith that real-time modeling with real numbers might suggest. Also we see immediately the way in which the specialized systems theories emanate from GST. These two advantages to the mathematical analogies out weigh what might appear at first their arbitrary nature. As we look more and more deeply into the analogies we find that what appears at first arbitrary is in fact a very subtle theory of the workings of

Dissipative, Autopoietic, and Reflexive systems that expands on the foundations of GST in many unexpected ways. We will explore many of these subtleties as this series of essays progress. At this point though it is necessary to fully understand the nature of the four layers of methodological distinctions as they compose the illusory continuity projected by ideation on phenomena within the world which allows us to isolate and model dynamical systems.

5. Pattern and Form

Having established the framework of stages of unfolding of GST and the special systems theories that emanate from it, we will go on to explore in more detail two ways of looking at systems that are very significant. In a previous paper I established what was called the emergent ontological levels for approaching phenomena. These were as follows:

- Pattern
- Form
- System
- Meta-System
- Domain
- World
- Universe
- Pluriverse

In that paper a plea was made to consider systems as Gestalts not as objects as Klir does in ASPS as do many other systems theorists in their works. Here we will assume that systems are Gestalts of showing and hiding relations and not static objects that are arbitrary collections of attributes arbitrarily selected by the observer. Given this perspective we will explore in detail the role played by Form and Pattern based on the work of Goertzel. Goertzel uses an odd definition of Pattern that is contrary to the one I have used in previous papers. For the purpose of this paper I will adopt Goertzel's definition of pattern as a gloss on an ordering of something. That gloss must be simpler than the ordering which it abstracts. [In my previous papers I did not use the term "ordering" but instead the term "pattern" to express the thing glossed.] I will now say that a pattern is a gloss of an ordering of something. The ordering is imposed by some ordering principle on the thing. The

thing ordered appears as a form which contains an ordering. Goertzel attempts to deal purely with patterns and forgets the forms which bear the ordering that the pattern describes and simplifies. What we wish to show here is that forms and patterns must be seen as intimately related. For instance, Goertzel often talks of patterns in strings of ones and zeros. But the strings are themselves the forms which bear the orderings of ones and zeros that can be described as a pattern. We cannot talk about patterns without forms except in the abstract. Every concrete embodiment of a pattern as an specific more complex ordering must be born by a form and conversely a form must contain ordered hyle in order to exist. Forms themselves are glosses of things so that when we recombine the glosses we see that the result is a structural-form which contains pattern within an outline of a thing. These two glosses imply each other inherently and are in fact inseparable.

The reason for this analysis is that I have stumbled over Goertzel's use of the term pattern in my attempt to use his ideas many times. This brought me to attempt to first get clear about his definition of a pattern as a gloss and then see how it works within his overall system of ideas. This has proved very difficult and eventually I realized it was because the concept of pattern by itself was incomplete. I realized that Pattern and Form were both dual glosses which implicate each other internally. And once I realized this essential relation I was in a better position to understand how Goertzel's magician systems relate to general systems theory and the hierarchy of special systems. I will try to describe the picture I have of the relation between the glosses of pattern to the glosses of form. I think this will be an advance of the notions of Husserl propounded in his phenomenology because he does not consider glosses of pattern but only glosses of form. In other words Husserl commits the opposite sin to that of Goertzel not considering the opposite dual formation and thus producing a flawed theoretical structure that leads to problems of coherence.

This is a complex interaction which will take some time to explain fully. However, as occurs many times if we oversimplify by making one particular concept the key to our thought then we run into problems later as our theoretical system flounders under its own weight. Patterns and forms should be just simple enough but not too simple. In other words we need to recognize the thresholds of complexity beyond which distortion becomes unbearable. Sometimes those thresholds are not as simple as we might wish.

We assume based on previous discussion that everything unconscious is not seen in consciousness because of internal symmetries which are broken for everything that

actually appears in consciousness. This is based on the work of Matte Blanco which to my knowledge is the first theorist to see the unconscious in terms of symmetries. At one focus of the ellipse of consciousness is an identity point which hides the part below the water of the iceberg of consciousness. The symmetries of the unconscious hides what is normally called the “unconscious” which is an always hidden source of disordering that Derrida called DifferAnce. DifferAnce is related to what Heidegger calls Being Crossed Out and what Merleau Ponty calls Hyper Being. All these are names for a source for the production of asymmetry beyond the symmetries that cancel each other out to make everything in the unconscious remain unmanifest. As Derrida’s analysis in Of Grammatology shows the gloss on the operation of the differing and deferring of DifferAnce appear as latent traces that represent the substrate of interferences that underlie all manifestation. Manifestation is composed of a myriad asymmetries that all interfere with each other and those interferences appear as glossed traces. Traces must be understood in the sense of the indentations in the substrate that show where signs have made impressions. When we write on a pad and then lift the sheet to expose the indentions which must be shaded to be seen we are looking at traces. Traces that gloss complex interference patterns too complex to be accurately described blend into the substrate itself. But some traces are sufficiently worn and defined to be seen as ultra-forms below the semiotic level. It is this level of ultra-forms that Derrida addresses in Of Grammatology.

Within consciousness, above the threshold of cancellation and annihilation in the symmetries of the unconscious there arise temporal gestalts. They arise like pairs of virtual particles arise out of the matrix of spacetime/timespace. In the envelope of the temporal gestalt asymmetries differentiate into processes which reach some point of full differentiation and then eventually vanish. For instance a tree starts as a seed and grows to its full height to produce seeds of its own and then eventually vanishes back into the earth. This whole process is seen as a temporal gestalt described by Heidegger’s Process Being that appears out of the substrate of Hyper Being and then disappears back into it. All during the unfolding of the temporal gestalt through successive ideal nows or specious presents there is a delicate balance between order and disorder in the relations of the asymmetries to each other as the temporal gestalt grows and then decays. It is my hypothesis that the relation between pattern and form as glosses are rooted in this delicate balance of order and disorder. In fact Order is seen on the background of Disorder and vice versa. When we look at the coherences of disorder we see forms and when we look at the coherences of disorder we see patterns. Forms and patterns are glosses on these

complex relations between order and disorder that can only be seen through each other. The order within the temporal gestalt is imposed by an ordering principle from nowhere operating through a singularity within the dissipative system. The form appears from a point of view of an observer interacting with the physical boundary of the dissipative system who holds a particular viewpoint. When we combine the glosses of form and pattern we get a structural form and when we see these in the context of showing and hiding relations that define the system we get a formal-structural system. This is to say that Klir's epistemological framework applies the interrelation of form to pattern glosses within the system defining each element as a structural form within the system.

Now when we look at Goertzel's examples of patterns we notice that their formal aspect is suppressed and their patterning aspect is accentuated. Likewise if we look at Husserl's phenomenology we see that the formal aspects are emphasized and the patterning aspects which would be distorted by essential deformation are suppressed. Both are partial views that need to be corrected by supplementing each other. Both views arise as glosses of what Husserl calls the noematic nuclei. Those independent views are separately cognized noetically and then recombined into a structural synthesis. Husserl does not represent the structural synthesis because his is essentially a purely formal view representative of the philosophical frameworks of his time. However, we can readily understand how individual objects can appear as formal-structural glosses composed of orthogonal pattern and form glosses combined according to the epistemological framework of Klir. Thus we posit that Klir's framework of epistemological levels applies to the objects within the systemic gestalt as well as to the whole gestalt. Between the noematic nucleus and the structural form of the object exists the essence seen by eidetic intuition as posited by Husserl. This essence has another aspect beyond that elucidated by Husserl. We will call that other aspect the *integra*. The *integra* is to the pattern what the essence is to the form. In other words there is an intuition of the inner coherence of the pattern similar to the intuition of the inner coherence of the form. The *integra* is the inner coherence of the repetition of the motif within the ordering of the pattern. Just as the form has attributes, essence (inner coherence), configuration and articulation (outward coherence), outline, and constraints so too the pattern has aspects, *integra* (inner coherence), repetition and difference (outer coherence), margins, and constraints. Pattern addresses the qualitative category of cognition while Form addresses the quantitative category of cognition. Thus the tradeoffs already discussed in the first part of this paper between quality and quantity apply to these two orthogonal aspects of all eventities. Pattern ultimately

arises out of the overlappings of Forms that express the wavelike nature of reality while Forms express the complementary particle view. The noematic nucleus must combine both of these complementary realities into a single phenomena embedded in the Matrix of spacetime/timespace. The structural form is a complex gloss that attempts to combine these two aspects back together into something we can understand within a single gaze as a model of the undecidable phenomena.

Now we are in a better position to see how patterns function in relation to forms when trying to understand Goertzel's models of chaotic processes. Goertzel is fond of using the concept of algorithmic definition of complexity as a way to create models of patterns these are embodied as turing machines with data and program tapes. The data is one pattern and the program is another pattern which when combined produces the original ordering that has been glossed. This is similar to Klir's idea of the generative epistemological level. The implications of the epistemological levels for software have already been expounded in a different paper by the author. Suffice it to say that these are structural-formal models of systems which attempt to recombine the pattern and form viewpoints, or quality and quantity viewpoints on essentially undecidable phenomena. All our structural-formal models are linearizations of phenomena based on these two orthogonal approaches to the phenomena itself.

These views are built up in stages by moving through the lattice of methodological distinctions. The executing program with its data is the actual production of illusory continuity. Below that we only have slices of turing machines which are static partial representations. Below that we only have the partial ordering stemming from the viewpoints that see everything in terms of autonomy or intentionality. Below that we only have givens that are swarms of independent partials. These arise out of the substrate of tendencies and possibilities that underlie all probabilistic manifestations of temporal gestalts. These temporal gestalts may be sliced by ideal planes representing moments in time but cannot ever be reduced to just a series of mappings from one of these planes to the next.

Now if we consider the string of ones and zeros we see that the string is a form and the ones and zeros form a pattern. Both the form and the pattern are orthogonal glosses of the actual offs and ons of the memory location. We can use this analogy because the artificial separation between patterns of memory locations has already been achieved within the computer complex. If we look out at the world around us this is a very artificial type of formation that almost never appears. We can see the

form as the rules that only allows linear ordered bits with values of one or zero to appear within the “string” formation. Different binary strings can only be compared or concatenated because we have the concept of a form which delimits one string from the other. So without the concept of “binary string” as a form the content of the pattern “100100100100” as a repetition of “100” four times could not be defined. The self-delimitation of the pattern depends on the delimitation of the form as the bearer of the pattern.

In this analysis we see that form and pattern are mutually implicating and interdependent. This analysis could be extended to the other ontologically emergent hierarchical levels. Here we needed to prove that pattern could not be understood without form in order to make use of these concepts. But a similar relation exists between all of the ontological hierarchical levels. They all mutually implicate each other. We could go on to show how we need the gestalt of the system to understand form and pattern or we need the meta-system in order to understand systems and so on up to the concept of world and beyond. This mutual interdependence of ontological levels is part of the synergy of our projection of the world. When we reduce everything to only one level we erase a great deal of tacit knowledge and oversimplify our relation to existence. Only by applying simultaneously all the emergent ontological levels can we unfold our tacit knowledge into the multidimensional explicit rendering of this knowledge. We call this knowledge tacit because we are merely describing the lens we all use to look at the phenomena. Everyone implicitly understand what patterns, forms, systems, meta-systems are because it is the result of our mutual project of socially constructing the world.

Finally we should acknowledge that the arising and vanishing of the temporal gestalt contains all the different kinds of Being that have been described in the first part of this paper. The temporal gestalt itself has Process Being as its basis. That may be sliced at multiple now points which represent Pure Presence. The cancellation of the symmetries that the temporal gestalt arises from and returns to reflects Hyper Being. The tendencies within the interface between Hyper and Process Beings that set each temporal gestalt onto its own unique unfolding course reflects Wild Being. All the kinds of Being work in concert to produce manifestation as we know it within the Western worldview. When we build models of what manifest and manifest those models we do so using the levels of methodological distinctions which underlie the full structural simulations that appear in Klir’s GST and underlie Goertzel’s concept of Magician systems as

general computing structures.

With magician systems Goertzel has successfully addressed a major flaw of GST which is the assumption of illusory continuity. Magician systems embody all the four kinds of Being together in a single model that assumes discontinuity instead of continuity. Goertzel shows we can simulate any continuous system with magicians but that magician systems are more broad in that they can also simulate nonlinear systems that lack continuity. I have dealt extensively with the magician system model in On The Social Construction Of Emergent Worlds. Here we merely want to mention that magician systems appear to be superior models for chaotic and nonlinear complex dynamical systems than the normal GST models that assume continuity. Our goal must be to reconcile the magician system structure with the levels of specialized systems as well as the general systems theory in order to prove its universality. We do this as a prelude to proposing that magician systems are especially suitable for modeling social systems within Artificial Intersubjectivity simulations that encompass all the lower level special systems as well as exemplifying general systems architecture.

6. Magicians and Special Systems Theory

In his draft paper “Complex Systems and Hyper-complex Fractals” Goertzel takes a crack at defining Magician systems in terms of algebras. In this section we will explore the odd algebras he comes up with and see how these relate to the Special Systems Theories that emanate from GST.

Basically Goertzel attempts to construct an algebra that is analogous to quaternions and fails. However, in this case the failure of the analogous is more enlightening than any success would have been. In effect Goertzel constructs a magician system as a system with three operators $M(+, *, \#)$ where “+” means annihilation, “*” means mutual action, and “#” means joining to form a gestalt. I will introduce the following change in notation so that we do not get confused with normal addition and multiplication operations.

Goertzel	Palmer	<u>Notations</u>
+	a!b	annihilation
*	a>b, a b, a<b	mutual action
#	a#b	gestalt joining

Thus a magician system is composed of a set of elements called magicians that can effect each other through a set of operations involving annihilation, mutual action, and gestalt joining. In formal notation this would be represented as $M[!,[>,|,<],\#]$. The operation for annihilation “!” will take two magicians a and b and make them mutually vanish, i.e. taking them out of manifestation together if they are dual canceling opposites. If not the operation will leave as a residue everything that cannot be canceled or in other words everything that is asymmetrical in the composites of magicians that are canceled.

$A ! B = C$ means that composite of magicians A is canceled with composite of magicians B to leave the asymmetrical residue C.

Besides canceling Magicians can act on each other to create other magicians. This action may be unidirectional or bidirectional. Unidirectional action is represented by a “>” or “<” showing the direction of influence. Bidirectional or balanced action is represented by “|” to show that each side influences the other. So for instance ! is one particular kind of |.

$A > B \Rightarrow C$ means that A acts on B to produce the result C. This is equivalent to saying $B < A \Rightarrow C$. But $A > B \neq A < B$. In other words actions may not be commutative. If they are commutative then they are represented with |.

Finally there is a join operation that produces higher level gestalts of patterns that combine magicians. The join operation # may also be used to create persistence and identity with dummy magicians.

$A \# B = C$ means that A and B combine into a whole greater than the sum of its parts called C. This joining operation may not be associative so we use parentheses as in “ $(A\#B)\#C \neq A\#(B\#C)$ ” to differentiate these sub-gestalts that may appear very different like the standard image of the young woman and the old hag that psychologists like to use to show how two gestalts of the same pattern may hide each other.

From this analysis it may be apparent the direction we are headed. Each operation within Goertzel's strange algebra connects to a different level of the special systems developed in the previous part of this series of essays. There is no unified single algebra that describes magician systems because these systems span all three levels of the unfolding of special systems.

- Annihilation “!” relates to dissipative systems and complex numbers.
- Action “<,” “|,” and “>” relates to autopoietic systems and quaternion numbers and specifically loses the commutative property as their Clifford algebras do.
- Gestalt joining “#” relates to the social reflexive systems and the octave numbers and specifically loses the associative properties as their Cayley algebras do.

The magician systems then span these levels of special systems and present us with a model that has special features connected to each level. Thus magician systems cannot be modeled by algebras but are supra-algebraic. Reducing them to algebras will only lead to distortions of either algebras or them. And we see this in Goertzel's valiant attempt to unify these two formations. Instead we see these operations as signifying the emergent properties of each special systems level which combine into a single formation that unifies them into a single dynamic formalism. Dissipative, autopoietic and reflexive systems can all be modeled by magicians because they are all subsets of the emergent properties that combine to form the magician system. Thus just as the GST is built up by the methodological distinctions so the Magician formalism is built up of the emergent properties of the special systems that operate together to create the possibility of dynamic magician systems. In this way the continuous simulation of the GST is the dual of the discontinuous simulation of the Magician system.

I think this is a startling result that shows the brilliance of the magician formalism in a striking manner. As show in On The Social Construction Of Emergent Worlds this model embodies all the different kinds of Being into a single formal model of discontinuous change that can mimic continuous change but allow us to model nonlinear complex systems as well. Now we see that the operations of this magician system also uses the emergent properties of each specialized system as its operations so that it unifies the special systems into a whole much like the whole of GST without rendering them a monolithic structure like the monolithic structure of GST. I believe that Goertzel should be commended for the intuitive leap that

formed such a model that is really the inverse of the static continuous GST structure. I doubt if anyone could have inverted the GST structure starting from first principles. Magician systems have all the right elements to model the different kinds of Being and the emergent properties of the special systems and no more. They are very elegant theoretical formations that have the wonderful characteristic of modeling complex or chaotic nonlinear dynamic systems much better than GST theoretical formations. Where GST excels at linear dynamic systems Magician systems excel at nonlinear dynamic systems. The two together model all known types of systems.

If we consider that magicians themselves might be seen as structural-forms then we see it is possible to actually combine the two kinds of dynamic modeling into a single model addresses both continuity and discontinuity at the same time with the strength of each model. This also allows us to consider what a magician is: in this analogy a magician is a structural form and so is a combination of form and pattern into a single undecidable whole. As such these wholes describe the epiphany, unfolding and vanishing of temporal gestalts which have certain operations of annihilation, action, and joining that operate between them. At each level of special system what this node is would change. Where only annihilation exists we would have a dissipative system. When we add action to annihilation we describe an dissipative autopoietic (living/cognitive) system. Finally when we add gestalt joining we are modeling social reflexive systems with dissipative autopoietic substrates. There may also be a degenerate form where annihilation and joining combine without action. Between the discontinuities of creation and destruction of magicians the structural-forms describe their genesis while evolution describes their group action over time. Because of this we must posit that the group of cohort magicians participate in some global genetic algorithm that defines there evolution as a group beyond the lifetimes of individuals. This genetic algorithm is the dual of the formal-structural meta-structures and meta-models that describe the genetic unfolding of individuals during their lifetime.

Goertzel's formulation of Magician systems can be seen in relation to the work of Ulf Grenander¹ who is one of the few mathematicians to do an exhausting study of Patterns of all kinds and to produces a mathematical model specifically designed to make patterns comprehensible. In this work he reduces all patterns to generators and bonds which produce images within a given medium. We can see the

1. Volume 1 Pattern Synthesis, Volume 2 Pattern Analysis, and Volume 3 Regular Structures; Lectures in Pattern Theory; NY: Springer Verlag 1976, 1978, 1981; Volumes 18, 24, 33 Applied Mathematical Sciences

generators here as being isomorphic to the actions of the magicians and the bonds as being isomorphic to their associations. He uses the letter g to stand for a generator and G to stand for the class of generators. He says that “The generators are the units carrying information and since they signify certain primitive statements they will sometimes be spoken of as the signs.” Generators have an index α partitions them into disjoint generator classes where generators that are “qualitatively” alike grouped. Generators have two types of properties: attributes and bonds. Attributes may be any kind of value but bonds are bivalent being either “in” or “outbound” links to other generators. To each potential bond connection is a “bond value” = β that determines whether other generators bonds can connect or not. So it is with the rules that apply to what bond values can connect that we get the connection to truth values and thus to logic. Generators have similarity transformations between each other that do not necessarily effect the information carried by the generator. Similarity transformations are at least semigroups and normally groups. Generators are normally considered as the primitives of Grenander’s approach to Patterns but he mentions that they can sometimes have internal structure in which case they are made up of images projected by some higher order level of generators. Generators can either be defined abstractly or in relation to a medium or information carrier. The normal case is for the generator to defined in relation to “a background space.” Such a background space can have transformations of its own which represent invariants for the generator.

Definition 3.1 If the generators are elements of the background space X they are called point generators.

Definition 3.2 If the generators are subsets of X they are called set generators.

Definition 3.3 Let the generators consist of mappings from the background space X into a contrast space Y . We then speak of contrast function generators.

Grenander goes on to define sources of generators giving several different examples including deterministic and stochastic sources. Also generators connections via their bonds may be stochastic or deterministic.

We can see that Grenander has a similar concept to the one that has been put forth in the first part of this essay that talks of ordering of dissipative systems. Sources of generators are similar to the concept of ordering principles. These operate concretely within the system as generators with attributes and bonds that project an image. For instance the rules in a cellular automata would be the sources of the cell generators and the neighborhood would be the bonds which create an image in the pixel associated with each cell that is the outcome of the local computation. In fact

the power of cellular automata as patterning devices comes from the near isomorphism with the universal pattern generation structure that Grenander is constructing. Sets of generators with their bonds are called “configurations.” The content of a configuration is determined by exactly what generators it contains and the structure of the configuration is determined by the Rules and restrictions on admissible bonds. Connection types for groups of bonds take on the types of order that are possible. Since bonds are graphs they can have various orders over and above those of methodological distinctions. But methodological distinctions form the substrate of all the graph orderings of generators. So we see now the connection between pattern generators and the methodological distinctions that we have taken as basic in GST. At each stage of building up the ordering possibilities of GST new variations in bond structures become admissible. Grenander speaks of free configurations, linear connection types, tree type connections, partial ordering, fully connected graphs.

It is of interest that Grenander speaks of the Annihilation and Homomorphisms of generators in one section¹. Since Grenander goes on to develop a Category Theoretic approach to Pattern generators it is clear that he is more interested in Homeomorphisms than with Annihilation of generators. However, he mentions these as alternative ways of producing mappings between Configuration Spaces. He says that Homeomorphisms are natural ways to study images of patterns and their deformations. He introduces the concept of an Annihilation operator that destroys all generators of the same class of generators. He notes that this does not normally lead to a homeomorphism between the pre and post annihilation sets. It creates new free bonds making some that were internal now external. I think here Grenander has passed over the possibility of a magician system. Because Annihilations do not produce homeomorphisms they are not as powerful from a mathematical perspective. Category theory cannot be applied so powerfully to patterning systems that involve Annihilation operators which is exactly what they have in Goertzel’s formulation. Goertzel does not consider bonds between magicians explicitly but does so secondarily in terms of gestalt joins. But what we see is that if we add this Annihilation operator to generators that lack the commutative property and bonds that lack the associative property then we have a magician system. Grenander comes very close to developing this theory and signals that the possibility of magician systems exists. He leaves it as a route untaken that later Goertzel formulates independently. If we add Grenander’s pattern generator

1.11. Mappings in Configuration Space. Page 91-93

work as an underpinning of Magician systems we get a very robust mathematical foundation for understanding patterns that agrees with the basic analysis that we presented with respect to dissipative systems and cellular automata. A Magician system equals Annihilation operator plus Non-commutative generators plus Non-Associative bonds along the lines that Grenander suggests and which align with the emergent properties of the special systems as they unfold.

7. Laws of Form and Pattern

If we have defined a formalism for describing the Operations of the magician systems we need to supplement that with a formalism which describes the GST based on the analysis of Methodological Distinctions and the Laws of Form of G. Spencer-Brown.

a' / a'' distinction

The distinction ‘/’ merely places separation between two areas of a space called a’ and a’’.

$a \backslash b$ crossing

Once we have established a distinction we can cross that mark in an act of transcendence. The crossing of the mark transforms it into a dynamic boundary. Crossing is always from inside (left) to outside (right). Spaces can always be nested to any depth. The deepest space is always on the left and the most superficial space is always on the right.

Spencer Brown confounds these two types of notation by representing them with a single mark which depending on its context represents either crossing or distinction.

┌	= / ->	distinction (top)
└	= \ ->	crossing (side)

Notice that within the single mark that is both operator and operand at the same time the two aspects are orthogonal to each other.

Since any distinction can be crossed once it is posited G. Spencer brown posits that

the operator of crossing is the same as the operand of distinction.

$$\backslash + / == \lrcorner$$

This is in fact an image of the ontological position of the Western worldview which assumes Ontological Monism, i.e. that Being grounds itself. We can say that every distinction makes itself by transgression. Since reflexive autopoiesis is an image of Ontological Monism and its inherent paradoxicality we can appreciate the way in which Spencer-Brown builds this presupposition into his formalism as an exemplification of the dominant interpretation of Being within the Western Tradition as Will to Power. Spencer-Brown formulates an operator that operates on itself. This is exactly what we would like to have as the basic unit underlying our formalism which is building toward reflexive autopoietic systems. However, we must be able to separate out the two components of the Spencer-Brown crossing-mark operator-operand which are crossing \backslash and distinction $/$.

Spencer Brown goes on to formulate two laws upon which he bases his calculi of form. For him “form” is a gestalt of the mark on its background.

$// = /$ which says that two distinctions collapse into a single distinction.

$\backslash\backslash = \text{‘null’}$ which says that two crosses of a distinction it ends up just the space without the distinction which we will represent as ‘null’ but should be seen as a blank.

These two rules are very significant because through them S-B generates the Boolean operands of his system. He proves that they are independent within his overall formal system, i.e. that they cannot be derived from each other.

The first axiom says that any distinction repeated is the same as the distinction made once. Iterated distinctions congeal into a single distinction made once. This is really an existential operator in the sense that no matter how many instances I have of a mark it only exists once. This is to say by having at least one of the mark it exists. Iterating the mark does not alter the fact of its existence.

The second axiom says that crossing and recrossing the same distinction puts you

back where you started or that doing something and then undoing it is the same as not doing it at all. Penelope undid her weaving every night in order to elude the marriage snares of the suitors. The undoing at night balanced the weaving by day so she in effect was standing still and not making any progress until her ruse was discovered.

By tying the crossing operators and distinguishing operands together into a single mark S-B gives us a formalism that has a fundamental reversibility in which we can consider distinctions and crossings in the same expressions. Thus multiple crossings are displayed by vertical layering of the right angled marks and the horizontal distinctions are also shown by the same mark. This is a very elegant formalism which is difficult to display in textual form.

AXIOM ONE:

$$\lrcorner \lrcorner = \lrcorner$$

These marks are at same level.

AXIOM TWO:

$$\begin{array}{c} \text{crossing} \uparrow \\ \lrcorner \lrcorner \\ \text{in} \quad \text{out} \\ \text{distinction} \rightarrow \end{array} = \begin{array}{l} \text{"null"} \\ \text{"blank"} \end{array}$$

These marks create a hierarchy.

However, as it turns out we are usually only interested in one aspect or the other at any one time so that the difference between backslash and slash will server our purposes for most of the time.

Spencer-Brown makes the point that the second axiom refers to reflexion which is also apropos to our attempts to build toward the definition of a social *reflexive* system. Reflexion means in both cases the mirroring of something back on itself.

In the case of S-B's second axiom the mirroring is represented as the action of undoing what is done. With respect to marks reiteration of a mark just reduces to the existence of the mark. With respect to crossings iteration of a boundary crossing merely erases it. Thus the two axioms have the opposite effects and produce the states of "null" or zero and one or existence respectively which are the Boolean operands that the system itself will operate on. Thus the elegance of the system continues to unfold because the system of axioms produce the contents of the system itself.

Operators = Operands
Axioms = Content

We can then see that the system itself is reflexive in the sense that all its elements are mirrors of each other across an implicit threshold of reversibility embedded within the formalism. Such a formalism is perfect for grounding our images of reflexive systems. But their usefulness goes beyond that because such systems allow us to have operations that are not inherently numeric or textual in nature. Thus the system represents a formalism prior to the bifurcation into numeric and textual descriptions of phenomena. This is because the formalism defines only distinctions regardless of the form of the distinction. It then allows us to manipulate distinctions based on operators that are equivalent to the distinctions themselves.

Number = Text

But the fact that we can operate on pure distinctions rather than distinctions in a particular medium is not the only benefit of this elegant formalism. What we notice is that S-B makes an equation of his first axiom with number and his second axiom with order. This then provides a profound insight. We normally represent everything as numbers that we can and what we cannot represent as numbers we represent with textual descriptions. Those textual descriptions normally describe the qualities of things that we cannot describe with numbers that are used to count forms. We have already noted that numbers count outlines of forms and that within forms are patterns that exemplify ordering principles. We see here that S-B is making the claim that his formalism describes also the reversibility between pattern and form as we defined it previously. At first it is hard to see how this could be the

case. But as we study it we note that series of crossings and recrossings produce an iterative pattern. In the pattern we are constantly returning to the ground state after the crossing and recrossing episodes. Thus Axiom two can be interpreted as saying that the fundamental pattern generator is the crossing and recrossing episodes which take us out of the ground state and then return us to it. Thus crossing and recrossing episodes leave a trace in the ground state which is the patterning of the form. By this patterning we can tell one delimited space from another. Notice here that the dynamism of the crossing-recrossing is converted into a trace which appears as a pattern. Thus the pattern exists between the trace and the dynamism of the form in a way similar to what we posited before.

If this interpretation of Spencer-Brown's formalism is true we see that it is indeed very elegant because it encompasses the chiasm between quality and quantity as well as all the other embedded reversible states already mentioned. We can understand this if we think of form as being made up of distinctions. Within a form the dynamism of crossing-recrossing distinctions creates the internal ordering of the form. We see this internal ordering as the gloss of pattern. The distinctions also externally define the form as multiple constraints. Externally all these distinctions that define the form reduce to the existence of the form itself. Internally the dynamic of the distinctions reduces to the ground state of the form itself as a tablet on which the patterns appear. But externally the form exists over and against other forms. So the two axioms not only describe the internal patterning of the form and the external outline of the form. This insight comes from the realization that the internal patterning of the form is merely a micro formalism. There are distinctions within the form and distinctions that define the form externally. The distinctions that define the form externally arise out of disorder to create the outline of the form. The distinctions that define the form internally arise out of order and create the internal ordering of the form where different orders vie with each other to order the content of the form. The content of the form is only seen by myriad of internal distinctions that are seen on the background of order provided by the stability of the form. The form itself is seen on the background of the diversity of all the other forms and so is an order on the background of disorder rather than the disorder of competing patterns on the background or order provided by the form. That background of order is signified by the "null" ground state established by the boundary of the form. The crossing-recrossing dynamism leaves traces that constitute the pattern as signs which fill the form ordering its contents. The multiple distinctions constraining the form give the form existence as a viable system of relations. That existence forms a boundary within which the content or

micro forms exist. Order is created out of disorder giving rise to the bounded form. Disorder is created out of the order of the ground state of the form and that allows us to see the pattern of ordering of the content. We can go on to posit that the first axiom of existence establishes the autonomy of the form while the second axiom of boundary dynamics establishes the structural-functional patterning within that autonomous and viable existent vessel.

We see that the ‘null’ = 0 and the ‘distinctive mark’ = 1 that are produced by the axioms are the actual content of the system itself. Thus the content is produced by the independent axioms of quality (autonomy) and quantity (functionality). These contents are firsts just as the dual axioms are themselves Firsts. But the axioms together produce the Thirds of the Function and Agent viewpoints by establishing the Secondary relations between the expressions that make up the two equated sides of each axiom. These four expressions form a minimal system of elements.

```
// = "null"  repetition = groundstate
\\ = "null"  reflexivity = groundstate      AXIOM 2
\\ = /       reflexivity = existence
// = /       repetition = existence      AXIOM 1
/ = "null"  existence = groundstate
// = \\     repetition = reflexivity
also due to the reversibility between / and \
\\ = \      reflexivity = crossing
// = \      repetition = crossing
```

So if we ask ourselves about the other possible relations between the minimal system of elements we get the picture presented above of other possible axioms not chosen by Spencer-Brown. Through these other axioms the complete revolution of self-grounding occurs. S-B picked orthogonal relations between minimal system components to produce his axioms. It must be remembered that all the equations of S-B’s formalism are reversible or self-dual. He could have chosen the following sets instead:

Possibility 1: (Laws of Pattern)

```
// = "null"      repetition = groundstate
\\ = /           reflexivity = existence
or
```

Possibility 2: (self-destructive identification)

/ = "null" existence = groundstate
// = \\ repetition = reflexivity

Possibility 1 has the same feature that it produces one and zero content elements as a result of the axioms. It is the opposite of the formalism chosen by S-B. In this formalism repetition instead of reflexivity produces the groundstate. Reflexivity instead of repetition produces existence of the single distinction.

In possibility 2 the equation / = 'null' is clearly false as is the equation relating reflexivity and repetition. It says that existence equals nonexistence and that repetition of the markers is the same as reflexivity across boundaries. Thus this possibility 2 could not be the basis of any formalism. In fact it is the destruction of the possibility of a formalism. If these equations are true then no formalism could exist because all the differences collapse. Thus we see that this Possibility 2 represents the self-cancellation of the system and can be equated with identity.

Spencer-Brown's Laws of Form

\\ = "null" reflexivity = groundstate AXIOM 2
// = / repetition = existence AXIOM 1

- Reality
- Materialism

Possibility 1: (Laws of Pattern)

// = "null" repetition = groundstate
\\ = / reflexivity = existence

- Truth
- Idealism

If we look back again at the dual axioms systems we see that the Spencer-Brown formulation equates repetition with existence rather than reflexivity. Thus we can say that we have a materialist formalism rather than an idealist formalism. Spencer-Brown sees reflexivity as generating the groundstate whereas the repetitions that fill

the groundstate produce existence. Such a system is oriented toward the definition of Reality because the reflective groundstate is the basis for understanding the repetitions that produce existence. On the other hand the Possibility 1 axiom set makes reflection the basis of existence and repetitions produce the groundstate. The repetitions are related to the verification process which needs to constantly be repeated to verify the truth of the propositions defined by the system.

If we look at the set of possible axioms that S-B had to choose from we see that the system itself embodies the three sub-concepts of Being: Reality, Truth and Identity. These also define the ellipse of consciousness as we have seen in Part One of this series of essays.

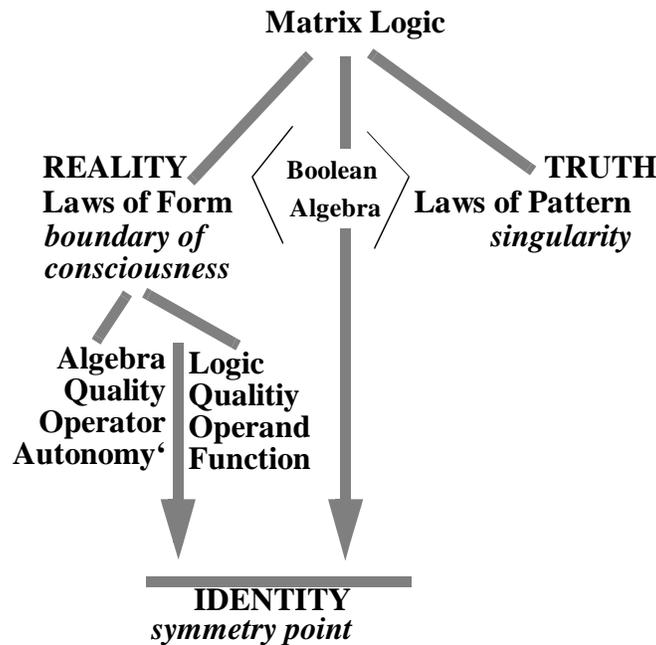
If we ask the question how Spencer-Brown produced such an elegant formalism the answer is in his introduction where he mentions Lord Russell. He mentions briefly the meta-levels which are an important result of Russell's work with Whitehead which occur in Principia Mathematica. Meta-levels are the opposite of Higher Logical Types. These concepts together embody Russell and Whitehead's solution to most paradoxes. Instead of paradoxes we have infinite proliferation of meta-levels like those we see in Klir's GST. The formalism of S-B is constructed in such a way so that it is multidimensionally at a meta-level above logic and mathematics. In other words it is set at a meta-level beyond truth and identity which represent the two focuses of the ellipse of consciousness. This is why he has chosen the axiom system that equates with reality. He has coded into this meta-level the proto-concepts necessary to generate both mathematics and logic. We can only understand his formalism if we look at it as constructing the meta-level language from which mathematics and logic are derived. This is why his system is equivalent to Boolean logic. Boolean Logic has dual embodiments as the S-B formalism and as the Possibility 1 formalism. Boolean logic can be seen as the interface between the two dual formalisms. In other words the Truth and Reality formalisms each extend Boolean logic beyond being just a pure mathematical system but in different directions. So this game of meta-levels forces us to ask what is at a higher meta-level than Boolean Logic and the answer is August Stearn's Matrix Logic.

We can only reach this higher meta-level that encompasses both Truth and Reality by dropping the excluded middle and accepting the extra truth values of -1 (neither) and 2 (both) besides 1 (true) and 0 (false). Spencer-Brown identifies the ground state with the false in order to make his system a Boolean equivalent system. This

is an artificial decision for the groundstate should actually be equated with the truth value 'neither' rather than false. However these higher level reversibilities only appear at the next higher meta-level of embedding.

When we consider the axioms in either the Truth (Idealist) (Possibility 1) or Reality (Materialist) version of the Laws of Form we note that they both are based on recursion. In one case the recursion is a repetition of marks that reduce to one mark. In the other case there is a recursion of crossings that take us back to the same place. Because recursion appears in these two guises we understand that we are dealing with a structure that can be used to define computability. Recursion generally is the form by which computability is defined. Recursion bifurcates to apply to marks of the same higher logical type or to different logical types. Note that a higher logical type is a lower meta-level. This bifurcation is exactly the same as the one that appears in the theory of logical types that needs not only meta-levels but also orders within meta-levels to solve the vicious circle paradox. This Ramified theory of logical types fell into disfavor because it did not allow many significant mathematical structures to exist. But as Copi shows the theory of meta-languages effectively has the same stratification not only into meta-levels but also orders within meta-levels to solve the same paradox. This reversibility in the application of recursion results in the orthogonal orders of crossings and markings which embodies the same structure as the ramified theory of logical types. Recursion theory like Boolean algebra is neutral with respect to this embodiment. The embodiment of recursion in the dual structure of crossing and marking or meta-levels and orders places a fundamental reversibility at the center of the Laws of Form that these mathematical structures do not have. But we must understand that Spencer-Brown was developing a system to solve engineering problems not a purely mathematical system. As such he needed an embodied system which described forms at a meta-level where any form can be described no matter what its physical manifestation. In this meta-level language of form we see the structure of Ramification exemplified not only in the orthogonal form of the mark symbol but also in the elegant combination of different categories (such as quality and quantity or operator and operand) in a synergistic way.

Figure 70:



8. Meta-levels of difference

Form without pattern. That is what the Laws of Form provide. We can think pattern as micro-forms which we construe as structures. However, the real problem is that the Laws of Form only contain one kind of difference. What we really need is a hierarchy of meta-levels of difference. Such a hierarchy has been suggested in my paper on “Software Ontology” in the series on Software Engineering Foundations. That hierarchy is represented in Table 1.

Here we see that there are a series of levels before we can even talk about difference. The first of these levels are our resources that we find in the world where there are natural complexes unordered unarranged by us which exhibit natural variety. They exemplify otherness and what is alien. We might call this unsuppressed discovered unadulterated variety. It is this level that deep ecology addresses when it seeks to preserve the wild for its own sake. Within that Wilderness we discover a sameness that is prior to identity. When we perceive that sameness our natural inclination is to emphasize it so we turn the wilderness into a rough hewn garden. We make subtle changes to enhance the aesthetic interplay of different things. Thus the garden of sameness is partially ordered by arranging and fitting together found natural complexes. At this level we do not distinguish ourselves from the things so that everything is embedded in the social matrix. We

are the same as them and they are the same as us. We are all things part of the Thing. The “Thing” was originally a social gathering. All things in their sameness are part of the social construction of the world we naturally impose on reality. Into this sameness enters anti-difference or identity which establishes the baseline on which all meta-levels of difference are distinguished. This in S-B’s terms would be the groundstate. Within the groundstate there is a hierarchy of difference that arises. The zero level of difference is content or hyle. This is the minimal structuralizable particles. This is the finest grid we can catch reality in using our forms at a particular strata of emergent phenomena. We must always remember that in each case we are addressing only one strata of emergent phenomena and that other strata exist below and above the strata being considered. In fact one thing we must keep in mind is that sometimes the different strata overlap so that what is a form at one strata is a trace at another strata. Strata in fact interpenetrate in such a way that different meta-levels within a strata might be aligned with other meta-levels of different strata. It is due to this overlapping that we get the impression that existence is continuous because strata bleed into each other causing lines of demarcation to be undecidable in ways that S-B’s Laws of Form does not consider.

It is important that the lowest level of difference can only be seen on the background of identity or anti-difference. We must clear the table and make a clean slate in order to see the lowest level of difference. It is within this lowest level of difference that pattern occurs. If not forms appeared at then next meta-level then we would have a plenum of patterned content which stretched indefinitely like an infinite cellular automata array. That pattern may be very dynamic like the states of the cellular automata array we explored in the last part of this essay and may produce illusory boundaries by dissipative processes. But it is only when we go to the next meta-level of difference that these boundaries become real. And it is that reality that Spencer-Brown attempts to capture with is meta-level three distinctions. These forms produce real encapsulating boundaries around patterns. As such they set up the difference between the physical boundary of the openly closed system and the etheric boundary at the singularities within the system that are the source of order form nowhere. The distinction at the first meta-level of difference has Pure Presence Being. As we climb the ladder of meta-levels the next level is that of the sign which signifies differences that make a difference. The distinguished distinction or demarcation at this level has Process Being. It appears as the diacritical marks by which we mark the marks of forms. In Spencer-Brown’s system these are the letters by which he differentiates different marks on their insides. System and structure appear at this level. System is the Gestalt process of

showing and hiding. Structure is the construction of a micro-formalism to define content and produce the formal-structural system (such as Klir's) that allows us to jump discontinuous boundaries at which forms disappear and are replaced by other forms. Most of science proceeds to analyze nature on the basis of these explanatory structural systems that are weaker than formal systems. For instance, the theory of the atom is such a structural model which explains chemical reactions. As Bateson points out it is normally thresholds or differences that make a difference that are important not pure zero level differences or formal differences. When we continue to climb the ladder of meta-levels we next meet third order difference which Derrida calls Differance which is made up of differing and deferring. These differences are seen as traces or interference patterns. The discriminated demarcations at the third meta-level have Hyper Being. They are the being of the discontinuities or the points of cancellation themselves. Derrida talks about them using the terms spacing, hinge, and erasure. He also calls them arche-writing in his book Of Grammatology. At the next meta-level of difference we have no traces because we are looking at the substance of the substrate itself. The substrate is the next level down in the hierarchy of strata of emergent levels. We see that next level down as an incomprehensible variety and see it as a palimpsest upon which the traces of this level are impressions. Merleau-Ponty talks about this level in terms of the Chiasm or reversibility of touch touching. Deleuze and Guattari speak of it in terms of the inscription into the flesh of the individual by the social group. We can think of it as the interference between traces or what is left after the cancellation of traces. This decision on the discrimination of the demarcation has Wild Being. The final meta-level is really the edge of the world in terms of thinkability. Instead of an infinite series of meta-levels of differences there are in fact only four. After four we reach the unthinkable that can be thought of as Emptiness. This is the trackless abode of lostness which is the source of all meaning as distinguished from significance. The discernment of a decision on a discrimination at this level is empty and even its "emptiness" is empty. This emptiness is non-experiential and non-conceptual. It is the empty center of the vortex of thought attempting to think itself at higher and higher meta-levels.

When we see the Laws of Form in relation to this series we see that Spencer-Brown was attempting to produce a formalism that could be applied at any of these levels. But what he did not take into account is that new language games must be played at each level and that no single language game can apply to all the levels. For this reason S-B did not attempt to develop a language of pattern to complement his language of Form. When we go to the library and look up "pattern" what we see is

that most of the entries refer to weaving, dressmaking, clothes material patterns, quilting and other endeavors traditionally associated with women. Where there are many treatises concerning form by men there are very few concerning patterns. What we might conclude from this is that culturally pattern is in the realm of women and is the manifestation of the negative fourfold where as form is seen to be in the realm of men and is a manifestation of the positive fourfold. This is a cultural bias which as caused patterns not to be studied to the same depth as forms. But as we have seen above we need the complementary gloss of pattern to supplement the gloss of form. This is because pattern sees order on the ground of disorder where as form sees disorder on the ground of order. These two glosses of the gestalt of order on the background of disorder and vice versa themselves interfere with each other and the interference is the realm of traces. Traces are seen on a background of the palimpsest of fading traces. Those traces are fading into the void. When we view the palimpsest as infinite variety we see it as Wild being. When we view the palimpsest as lacking all variety we see it as fading into the void like Chinese paintings where the unpainted paper becomes the clouds that hide the forms.

Now we are in a better position to understand more fully the limitations of the Laws of Form. Spencer-Brown picked one type of difference, the first meta-level of difference, to construct his formalism on. That kind of difference is clear and distinct. But that kind of difference immediately ramifies to lower and lower logical types or higher and higher meta-levels. So for instance when we go from difference level one that is static and clear to difference level two which is only indicated by diacritical marks that indicate like temporal subscripts changes then we enter the level of processes. In fact we can see crossings as a process distinction whereas markings is a pure presence type of difference. So now we can see why Spencer-Brown allows his differences to ramify mirroring the ramified structure of higher logical types. In order to solve all paradoxes we have to appeal to higher and higher meta-languages. All paradoxes eventually hit the barrier of enigma or unthinkability. Thus we posit that only four meta-levels are necessary to solve all thinkable paradoxes. The Laws of Form carry only one ramification from the level of Pure Presence to the Process level of Being. By doing so Spencer-Brown produces a formal structural system that covers content by producing a micro-formalism and dealing with it as a structural system. In other words the second level of meta-difference is used to describe zero level differences between contents. But S-B does not consider the fact that ramification continues for two more meta-levels. Thus he does not discover the level of fuzzy sets which operate at meta-level three nor the level of chaos that operates at meta-level four. In order to make

his system complete we would have to add these nuances. The level of traces (meta-level three) describes the interference between form and pattern. The level of no-trace (meta-level four) describes what appears after the cancellation of the traces. When traces cancel no traces are left but this is not nothing. Instead this is a wild and profuse ultra complex and even chaotic variety which wafts in and out of existence and is inundated by the void.

?	alterity, what is antithetical to complementarity
A&B	sameness, complementarity, belonging together
I	identity, no content or form or trace, repression
aaa.bbb	zero order difference, content
A/B	first order difference, form
A%B	second order difference that makes a difference, sign
A\$B	differAnce A supplements B differing/deferring, trace
A@B	fourth order difference of the palimpsest, no-trace
null	fifth order difference of the void or emptiness.

These are some notations for the different kinds of distinctions that are necessary to give any Law of Form the full panoply of differences necessary to make it useful for understanding the world through the ontological layers through which it is constituted.

9. Ordering of Patterns

First we must establish the notation for “and” and “or” relations that appear in Boolean logic.

\wedge = and
 \vee = or

Then when we move beyond unordered distinctions we can build up ordered systems of distinctions by moving through the lattice of methodological distinctions.

$A \vee [B \vee C]$ partial order

At stage two we introduce partial order which allows “or” type relations between

elements. Partial order allows undecidable relations between elements. This is a very loose ordering which is colder than free-floating distinctions but still very warm. After partial ordering the relations between elements freezes substantially into two separate but equal possibilities:

$A \wedge B \wedge C$ linear order

$A -v- [B -v- C]$ partial order with definite relations

Linear order can be seen as being constructed with “and” relations between elements. This gives a very rigid structure in which the sequence is known and does not vary even though the exact distance remains unknown between the elements. Similarly we can think of partial order with distance as an equally rigid structural configuration. Here we substitute for distance the idea of definite relations of other kinds. This is signified by the sign “-v-” where the “or” is surrounded by dashes to show the presence of a definite relation. That definite relation should be designated by a superscript. A definite relation is any like distance that provides something like a metric telling how far apart the elements are even though we do not know their order.

$A -^-[B -^-[C]$ full order = linear order with definite relations

Finally when we combined linear order with distance or definite relations between elements we have full ordering. We are most comfortable with working with full order. It is the ordering of the real numbers. But we can think of other kinds of orderings that are both sequential and have metrics associated with them besides the real numbers. For instance graphs with distances associated with each arc would give a full ordering even if we did not express these as real numbers.

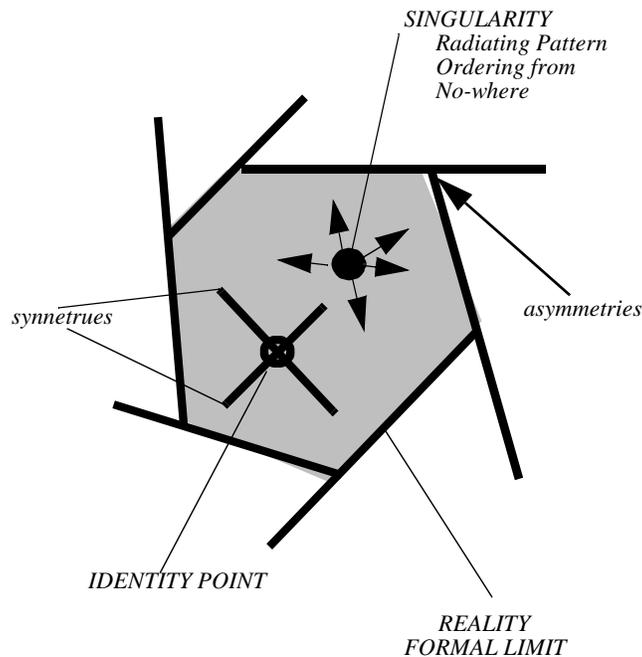
We can think of these levels of ordering as representations of the possible orderings of Grenander bonds between generators. Graphs, of course, have additional ordering possibilities that are added to these fundamental orderings based on the methodological distinctions. For instance, graphs can form rings or other interesting topologies that these metrics themselves do not encompass.

What we need if we want to have a general theory of pattern is precisely a theory of

order which is what our reconstruction of GST based on methodological distinctions gives us. Each successive stage adds a kind of order to our arsenal of types of order until we achieve our goal of full ordering. It is difficult for us to think of anything less than full ordering so strong is our wish to project continuity on the world. But that full ordering that is assumed by GST is built up layer by layer and some phenomena fall out at certain stages and refuse any further ordering. This is the real reason that patterns are so difficult for us to deal with in a theory of GST that concentrates on the level of forms. Patterns do not always lend themselves to full ordering. Thus Patterns are ignored by our theories that want to see the world full of continuities. Patterns many times contain multiple inter-embedded discontinuities both within orders and between orders. Patterns are difficult to deal with at the level of pure presence where continuity is projected. That is why we go beyond that level to the level of signs or processes in order to come back to structural models of content. We pass over content and then come back to it with micro-formalisms after we have produced continuous formalisms. We can see GST as a structural formalism which uses form to model content which is patterned. Pattern is never addressed in its own right non-structurally. It is only addressed after content is produced by anti-difference. The actual patterns are unhewn or rough hewn below the repression of anti-difference. It is this repressed land that women have traditionally inhabited in our culture and that is why they are so often identified with the unconscious which is what is beyond the symmetry point of identity. Women are seen either as the Other as in Greek society or they are seen as the Same as men in that they are seen in terms of their belonging together with men. The negative fourfold arises between the Sameness and the Alterity of women. The negative fourfold is the ontological dual of the positive fourfold that inhabits the world of light beyond the repression of identity. All the layers of meta-levels of Being and difference are the embodiment of the positive fourfold.

Reflexive Autopoietic Systems Theory

Figure 71:



So by taking GST as being composed by stages of order we are in fact filling the form of GST with patterns and developing a pattern language by which we can understand pattern in its own right rather than as a micro-formalism. All patterns are created through the application of the different kinds of order found in the lattice of methodological distinctions. These patterns fill the form of GST and allow us to structurally model dynamic forms. We see that the Laws of Form represents the interface of consciousness with reality though the collision with the boundaries of things. On the other hand there is the dual of the Laws of Form that relates to truth and thus language and thus ordering which is represented by the axioms of Possibility 1.

// = "null"	repetition = groundstate
\\ = /	reflexivity = existence

In this dual it is repetition that produces the ground state not reflexivity. It is reflexivity that produces existence and not repetition. This dual produces patterns. It is repetitions of the marker which are signified by diacritical marks (/' /") These diacritical marks on their own separate from the marks mean nothing. Thus if we consider the relation between the repeated marks as pure diacriticality then that

diacriticality translates into the pure diacriticality of the groundstate. This is the basis of semiotics that consider all marks to have meaning only based on their difference from all other marks present in the field. The groundstate is this plenum of pure difference by diacriticality. Thus repetition taken to its logical extreme of infinite repetition leads to the pure diacriticality of the groundstate. On the other hand reflexivity leads to existence. Here we are ramifying in the opposite direction as Spencer-Brown. We recognize that reflexivity has Process Being and we see that between the reflexive crossings there is a pure distinction. We say that crossing and recrossing leaves a level one difference instead of no difference. This is the opposite of what S-B infers. Thus reflexivity leaves a trace as we said earlier. That trace of reflexivity is the means by which the patterns are built up and the ordering occurs. So we see that patterns are seen as arising as repetitions on the background of the groundstate of pure diacriticality and that they are laid down by the recursive action of reflexivity that leaves a trace. The trace is left at one higher logical typing level than the process that leaves the trace. This means that the trace could be at any level of the hierarchy of differences rather than just at the level that we posit our formalism.

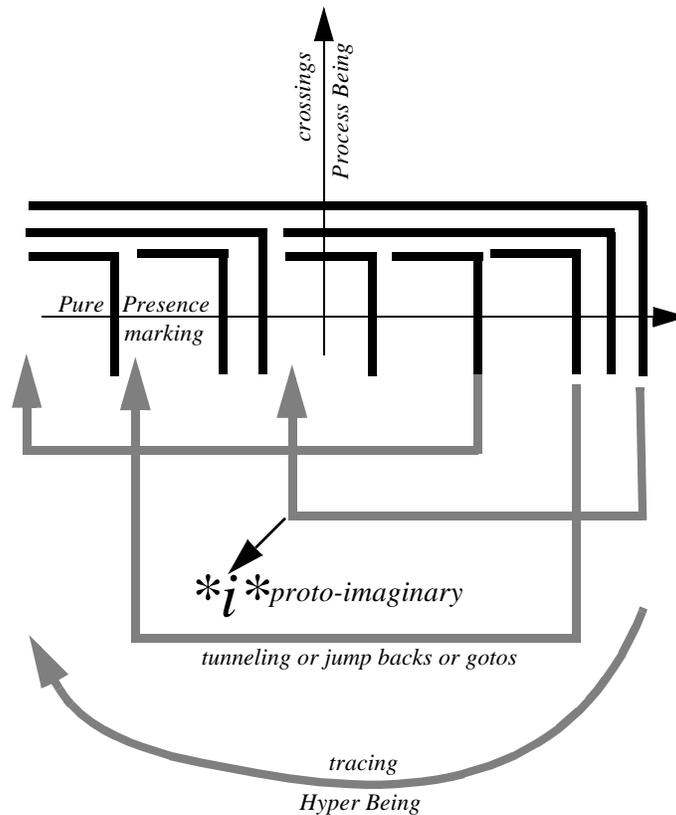
So the Axioms of possibility one produce orderings that can be glossed as patterns whereas the axioms that Spencer-Brown selects produces formal glosses of disorder. Possibility one creates a picture of order on the background of disorder beyond the form whereas Spencer-Brown's formalism produces a picture of disorder of the content within the form considered as pure hyle or content on the background of order imposed by the boundaries of the form. Or again we can say that the pure disorder is what lies beyond the form. To formalism both the disorder of the content and the disorder of the environment is identical. But to a pattern language the disorder is a means of seeing order wherever it appears. The disorder is introduced by the form into the ordering of the pattern. The form is the boundary with disorder. That is why we have a dissipative system. Ordering produces a boundary with other orders as it spreads. That boundary is made real by the form. Without the boundary being made real it remains an illusory by product. This is why Spencer-Brown's Laws of Form describe reality. On the other hand the Laws of Pattern are oriented toward the mind or soul or what ever you want to call the disembodied ordering principle that imposes order from nowhere within the system. The laws of form have an embodied observer where as the Laws of Pattern have a disembodied actor that imposes them from the heavens of "no where."

10. Recursiveness within the Laws of Form and Pattern

The key point to which Spencer-Brown reaches in his book *Laws of Form* is the description of time. It is time by which he represents the level of traces. This is done by allowing recursive execution of equations in which the signs change that identify the insides of marks. This transforming his formalism into a dynamism is really the whole point of the construction of the formalism. By making it dynamic it is able to solve problems that normally would not be capable of being solved otherwise. This is because when these systems allow recursive definition and are activated then certain ambiguous states are created which are equivalent to imaginary numbers. However we must remember that here we are at a meta-level higher than the appearance of imaginaries as numbers. It is these imaginaries that we are interested in because it is possible to see them as the precursors of the imaginaries produced at the complex, quaternion, and octave level algebras. It also allows us to see that we do not have to think of these algebraic imaginaries as only numbers. Because Spencer-Brown is operating at a level prior to the differentiation of quality and quantity we can see that these imaginaries are more general ethereals. In fact our hierarchy of meta-differences allow us to understand them. We see that the next level after processes within the ramification is traces. Traces are not signs or forms but the indentations in the palimpsest. Imaginaries are traces. Traces are not nothing. Traces are in fact the wavelike nature of the forms that emanate beyond the forms into the matrix of spacetime/timespace. They are something so subtle that they cannot be represented by diacritical marks or forms. These traces interact with the signs and forms so that we can actually find the pivots of those interactions even though we cannot actually see the differences between those traces and the signs or forms they interact with. Traces can be seen as fixed points around which the signs that differentiate the repetitions of forms and the forms themselves revolve. The revolution around these fixed points has the strange twist of the imaginary numbers so that it is an involution rather than a straight forward revolution. The fixed points that appear in numbers as the square root of negative one allow the solution of problems that would not be soluble if we just considered forms and their processes alone. The trace level shows that forms and their processes at certain times seem to disappear and then reappear. When this occurs they are really being transformed through the trace level of manifestation represented by Being meta-level four (Hyper Being). The disappearance points are discontinuities of cancellation. But even when cancellation occurs there are traces left which become the fixed points of forms and signs. This is why we say that forms have substance, because they have this invisible afterimage which exists when we can no longer see them. They are transformed through that vanishing point back into other configurations of formal outlines and diacritical signs as they

cross the discontinuity of cancellation. If we reinterpret imaginary numbers as traces then we find we have a general theory of why these undifferentiable kinds of numbers exist. Numbers are forms. Differences in numbers are diacritical marks. But we cannot tell the difference between the different kinds of numbers that represent the different levels of imaginary numbers unless we mark them specially (with i, j, k) or hold those different kinds of numbers in conjunction. When we hold them in conjunction then the different kinds of algebra appear that include them. Only in these nets of relations between different kinds of numbers held in conjunction do these differences at the trace level appear. And how do they appear? They appear as discontinuities between different kinds of numbers that otherwise appear identical. Thus they represent a direct link to the unconscious and its symmetries. These traces appear directly out of the unconscious as the differing and deferring of differAnce. They are the breaks within the continuity of consciousness. And these imaginaries that are traces appear within Spencer-Brown's formalism as well when he adds dynamic recursion and presses to the next meta-level of ramification which has the properties of Hyper-Being.

Figure 72:



The fact that imaginaries are traces is a major realization that allows us to

understand our analogies between hypercomplex numbers and their algebras and the different special systems. Think of general systems theory as producing a formal-structural system composed of structuralized forms (that is diacritical forms where micro-formalisms are used to dominate content of the forms) that can explain the jumps of forms across discontinuities where they are transformed. Thus all of GST understands only form and content of those forms but does not understand the discontinuities across which forms jump and through which they are transformed. The discontinuities themselves exist at a meta-level up as differences. At this meta-level up there are not forms or signs but only traces. Traces are the wavelike counter image of the diacritical forms. They are the impressions in the substance bearing the forms rather than the forms themselves. Now when we consider the Laws of Form we see that it represents time as tunneling. That is we see time enter as recursion through the tunneling which might be seen as illegal “gotos” in which boundaries are crossed by moving into another dimension that makes crossings that could not normally be made possible. Differing and deferring are higher dimensional crossings of boundaries set up at lower dimensional levels. When these crossings are made dynamic they produce an image of Time as Difference rather than time as process. Time as process means continuous time where things flow in sequence. Time as Difference means higher dimensional jumps that activate the forms and their repetitions in unnatural ways. So we can see that Spencer-Brown’s formalism when activated produces an image of the temporalization of Hyper Being which jumps across the discontinuities that break up the formal and process levels. At that level the forms and processes exist merely as traces that is they only exist as waveforms. The waveforms are transposed, transmuted, transformed, transduced in the medium of the substance of a given strata. The substance itself is composed of the virtual particles existing at the Wild Being level. It is a glass darkly through which we view the next emergent level down, the next strata of phenomena out of which the current level, whatever that is, uses to embody itself within the matrix of spacetime/timespace. Each emergent level can be seen as a different order of warpages in spacetime. At each emergent level new characteristics appear which take advantage of the degrees of freedom that are created by the next level down. But at a given level there is a completely new set of constraints on order and disorder. The interactions of these constraints within the degrees of freedom set up by the lower level allows us to view each level anew in terms of the four kinds of Being. Wild Being is the production of endless variety of tendencies within the clearing of the degrees of freedom set up by the lower level. There are symmetry breakings in which some of these tendencies become chords that channel morphogenesis within the new emergent level. Forms

develop thorough processes guided by the chords. Thus the level of traces are the same as what Waddington calls the chords or channeling of tendencies into possibilities which are then followed probabilistically by determinate forms.

The imaginaries at the trace level are the interaction of the probabilities with the propensities to create possibilities. When a form enters into a potential channel it becomes a trace. In physics there is the difference between potential and kinetic energy. Potential energy is really just a point where the actual energy has been transformed into an information configuration concerning the whole system. The book is lying on the table. In standard physics this configuration of the system is said to have potential energy. The energy is latent which means it has been transformed into a trace within the system. It does not appear as a form ($E=mc^2$ allows energy to become a form), nor does it appear as any process. The activity of the energy is arrested or held in potentia. It has become a trace which we can see as encoded in the information about the configuration of the system as a whole. From this state of potentia the energy can be unleashed again as when the book falls off the table. From this we see that forms or processes when they become transformed into traces become static and can only be seen by information that describes the configuration of the whole system. The meaning of any one piece of information is deferred until all the information about the system is presented. All the differences must be understood in relation to each other in order to see the traces of the frozen process or the latent form. However, these traces are not static in relation to each other. They take part in the dance of DifferAnce in which there are higher dimensional reenterings of the system of processes and forms from unexpected angles which produce an underlying turmoil and incomprehensibility within the system as a whole. So the imaginaries come to stand for the still points in this overall involution of the system of traces as a whole. These still points are seen by Spencer-Brown as nodes in the system of forms and processes where things are half true or half false which is to say undecidable. By using these undecidable points we can understand the revolution of the entire system around the fixed points of involution and thus solve formal problems we could not otherwise solve. When these fixed points are projected from the meta-level of Spencer-Brown's formalism down into numbers we get the pattern of complex, quaternion, and octave numbers and their algebras. These are just numerical images of sets of fixed points. These same sets of fixed points should equally well apply to pattern. If we take music to be the primal example of patterning, and realize that the eight notes of the octave scale probably are set up to approximate the eight pure imaginary fixed points that characterize the social reflexive level then we can think of music in terms of

involutions around the eight fixed points. We notice that in most music it takes several musicians working together to produce robust music then we see this social action as attempting to produce dances around the fixed point by complex patterning actions in concert.

The levels of imaginary or trace fixed points can be thought at a level prior to the arising of the difference between quantity or quality as different or can be thought of in terms of quality and quantity respectively. The special systems may be seen as the means of transforming the structural form of GST into a trace structure. We transform the overall GST structural-formal system into a trace structure step by step. First we recognize that involutions of continuous transformations are possible at the complex level. Then we note that these involutions can be composed first into quaternions that represent the perpetual motion rotations unique to four dimensional space and then composed into reflective structures at the octave level. All higher dimensions are described by reflexive symmetries so that the octave structure has not higher counterparts. We can understand this in terms of the introduction of cancellations or annihilations at the complex level. This is the appearance of discontinuities within the formal-structural system. The discontinuities are introduced in such a way that all the normal continuities of algebra are preserved but at the cost of an involuting twist. The discontinuity between complex and real numbers localize the fixed point at the square root of negative one around which useful involutions that solve quadratic equations occur. Next is occurs to Hamilton that these involutions can be composed if we can accept losing the commutative property. Now the single fixed point at the square root of negative one transforms into three fixed points around which other coordinated involutions can occur. These allow us to describe the action of perfect rotations and real rotations as a degenerate case. Thus as with Goertzel's magician formalism here action appears as the emergent quality of this level. The action is the perfection of processes though the involution of processes. In other words because the commutative property vanishes we need action to appear in order to allow us to recover from any reversible action through a series of other actions. Those other actions form a group which can become a hyper-cycle of groups that will allow homeostasis to be maintained. However, the group of actions as a whole make possible the description of perfect or entropy free groups of actions in which two dissipative systems interact to produce neg-entropic formations. Thus the quaternion rotations describe this possibility of neg-entropy which becomes the threshold of complexity in systems where living/cognitive systems thrive. At this threshold of complexity autopoietic systems become a possibility. Notice that

quaternions can be used to describe real rotations in three dimensional space or the perfect rotations of perpetual motion machines in four dimensional space. Perpetual motion machines can only appear in three dimensional space as temporal phenomena. Thus the autopoietic system is a closed system that enacts perpetual motion temporally by turning back on itself and maintaining its own organization. But this temporal structure has an image as a frozen four dimensional structure of the perpetual motion machine. Perpetual motion is equivalent to no motion just as for Spencer-Brown all distinctions is equivalent to no distinction. Thus we can see this static image of the perpetual motion machine as the next level of a reduction to traces of the formal structural system. The dynamism of the formal-structural system in this special perfect form becomes a stasis -- the stasis of maintaining its own organization indefinitely.

Next we see that at the octave level even the motion of action is reduced to traces because the fixed points become the locuses of reflections. Once the perpetual motion machine is doubled then it becomes merely a reflection of itself and all action ceases. At this level the associative property is lost and social connectivity becomes the manifesting property that appears within the reflexions thorough the mirrorings of the fixed points. At this level as Goertzel points out different gestalt pattern formations appear as various different patterns appear and disappear through the non-action of reversibility. The infinite mirroring beyond this point describes higher and higher levels of synergy of forms and signs and traces in configuration. The trace level ultimately reduces to the infinite mirroring of the interferences between the wavelike natures of the forms. When forms reduce to traces they are seen only as information configurations which as written texts rather than dynamic processes and reflect the differing and deferring of DifferAnce which disturbs all texts which may be seen as an infinite series of supplements. As frozen information the interference pattern in which all the texts vie for significance appears as an in-finte hall of mirrors. It is an ultimate configuration of interpenetrating synergy called by the Buddhists "Indra's web" in which every form reflects the differences of all the other forms. Each process reflects the transformations of all the other processes and taken from a four dimensional timespace perspective all these processes are frozen worldlines. The frozen worldlines of processes become configurational information structures that exhibit differing and deferring as they interfere with each other as wavelike structures that underlie their appearances as forms. These traces of forms can be seen as static or dynamic. They are dynamic when we see the interference patterns of the waves but we must understand that all these interference patterns also produce standing waves

which do not move within the overall configuration. The standing waves are the fixed points around which the whole structure of interfering waves revolves and self-transforms. Ultimately the whole of the formal-structural system can be reduced to these patterns of static standing waves at the trace level that intersect at the fixed point of the eight octaves. The reflection across the fixed points of the standing wave pattern gives the reflexive nature of this level that is produced when two autopoietic systems are brought into conjunction as a social unity. At this level we can see the whole of GST turned into a potential and that potential is used as the motive force of the social system which is full of potential for forms to spring from it and transform through it. This is why we say that the social has an essential characteristic of producing emergent phenomena. The social is the ultimate flattening out of all forms into traces or informational configurations and it acts as a surface on which forms will be transformed, transmuted, transduced, etc. The nature of this surface is itself rooted in Wild Being and is composed of the social substance of chaotic tendencies and propensities but it acts in relation to the GST as the surface or substance into which the formal-structural eventities are reduced to traces in order to be transformed into something else. The propensities deform those transformations but the entire surface itself acts as a register for the recording of the forms and structures as traces so that they can give rise to trans-forms and trans-structures within the whole system of reflections.

The three levels of special systems successively reduce formal-structural eventities to traces from which they can spring back as other forms and structural patternings. They take forms and structures and replace them with informational configurations of pure potential. Out of this potential springs the transformed forms some of which exhibit negentropy, living/cognitive structures, and social reflexivity. But beyond traces there is still no-trace of the substance of the strata into which the impression of the traces are pressed. That substance is itself social and composed of chaotic tendencies and propensities. For the genuine emergence of new forms to occur this substance must itself become active instead of being merely the passive bearer of traces. The activity of the social substance is its enveloping of all traces, signs and forms. This appears in the intaglio where different configurations of forms, signs, and traces interact. If we do not look at the forms, diacritical signs by which structures are marked, and the traces but at the distancing between them then we see the level of no-trace itself which forms the strange substance that envelops everything. It is like the level of virtual particles within space hidden by the conservation laws of physics. Everything genuinely new must spring from this substance given the chaotic propensities it represents. Deleuze and Guattari call

this the schizophrenic substrate of the socius. Stanford Beer talks about it in terms of the endless variety production of human enterprise. By reducing all the structural forms successively to traces by the special systems we finally see that there is something beyond traces that leaves no trace, which is the social substance itself. Beyond reflexivity there is the chiasm of reversibility which holds the reflexive opposites together and at the same time apart. We call this the intaglio substructure of the social layer itself which is seen in our touch touching and in our social relations as the fused group that Sartre identifies and studies in Critique Of Dialectical Reason and that Cennetti identifies in Crouds And Power as the pack nature of human beings. We identify it with mundane marriage in which we experience the intaglio of our selves and our partner though a non-nihilistic distinction between the married and the unmarried which expresses a social bond. At the level of no-trace we see the impression of non-nihilistic distinctions formed in the void within the variety production that underlies our world. With marriage that variety production is seen as reproduction which is constrained by social bonds that are non-nihilistic distinctions. You cannot tell a married person from an unmarried person just by looking at them unless they carry some sign. That difference occurs at the fifth meta-level in the trackless lostness of emptiness. But all of the social fabric in traditional societies and still in most segments of modern societies are organized around that difference. It is a difference that arises from nowhere to organize variety production as it occurs in humans as reproduction. Variety production when so organized creates the trace structure of the society -- those invisible lines of force that everyone feels and which orients behavior but about which no one speaks. These traces are seen in terms of what never happens or what always happens within torn social fabric which is made discontinuous by social taboos. These give rise to marks and processes such as the initiation processes that create structural images of this invisible landscape. And finally these give rise to forms such as the household unit, the family, and other human relations described by the Confucians under the rubric of “ren” or human kindness. Human kindness within the Chinese system of thought gives us a picture of the phenomenology of mundane love. That is the actual love between brothers, between husband and wife, between parents and child, and between emperor and his people. “Ren” is the practical manifestation of love between kinds within society. Within the history of Confucianism in China it became reified into a proscriptive ossified and stratified picture of these relations. However, prior to this ossification it pointed to the omnipresent phenomena of mundane love which all degenerative social relations must be compared to to be understood. An example of such degenerative relations is romantic love which is idealized within the western

tradition which lacks balanced perspective on everything. It is the balanced perspective that the Chinese strove to attain and which they occasionally achieved as the basis of their social relations.

11. Kinds of Truth

Now a point that needs to be explored further is Spencer-Brown's notion of undecidable truth. He represents this kind of truth by the letters **i** and **j** and describes them to proto-imaginaries. They are part-true and part-false stable points within the traces that the formal structural system revolves around. As has been said previously the formalisms of the Laws of Form can be balanced against its dual which represents the Laws of Pattern. Both of these together are one meta-level down from what August Stern calls "Matrix Logic." Matrix Logic uses matrix manipulations by truth tables of truth vectors to expand to a higher level of logic our traditional notions of logic. As we know logic only operates on the truth values of statements (Predicates). Individual statements are evaluated as to their truths and logic manipulates the truth values. But these statements themselves represent relations within states of affairs or we might say informational configurations. When we reduce a statement to its truth we are evaluating a relation. So relations have truths not the entities that make up the relations or are connected by the relations. The statement "John is true" is only meaningful in relation to his wife or lover. In other words the relation is always true or false not the entities that take part in the relation.

In Matrix Logic there are not just two truth values but four. These truth values are as follows:

2 = both true and false			
1 = true			
0 = false			
-1 = neither (does not apply)			
-1	0	1	2
neither	false	true	both
0	0	1	1
0	1	0	1

These are the traditional values of Indian Logic which was not distorted by the doctrine of excluded middle as our Logic was in the Western Tradition. We are only now starting to break free of these distortions in our way of looking at truth.

to attempt to attain the balance of quality and quantity again that was lost when the level of the proto-imaginaries was breached.

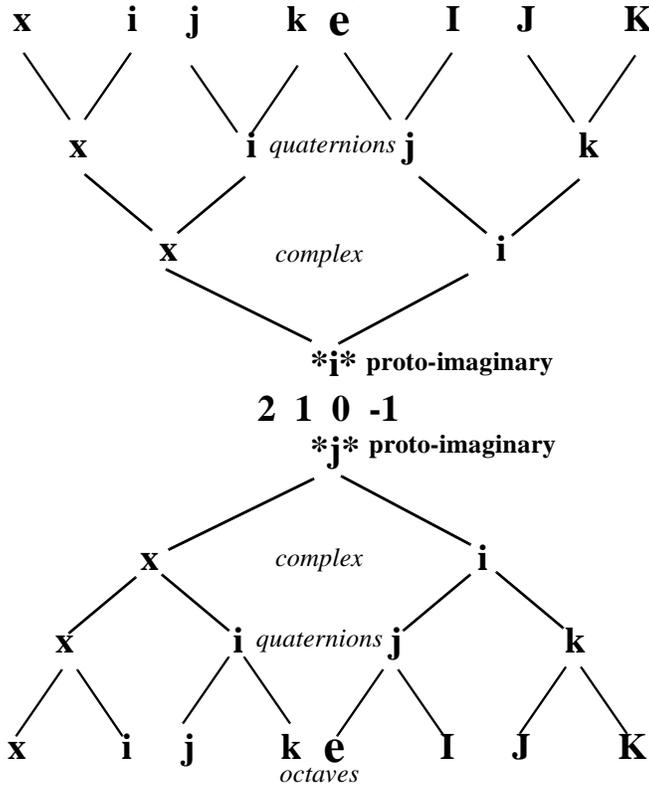
However we can look at this a different way. We know that Matrix Logic is at a meta-level higher than both the Laws of Form and the Laws of Pattern. It is for this reason it can deal with the context of the truth values of relations. Within either the Laws of Form or the Laws of Pattern we only get proto-imaginaries which then differentiate when quality and quantity separate at the next level down. The proto-imaginaries are only internal to each system and neither system can see what is external to it. But it is clear that the Laws of Form formalism is what is external to the Laws of Pattern and vice versa. Thus when we relate them to each other we get the ability to see the context of the statement of relation and thus judge the fittingness of the relation in order to see “both” and “neither” truth values of relations as significant. In fact we can speculate that the proto-imaginaries are the worm-holes between the Laws of Form and the Laws of Pattern complementary formalisms. Each formalism contains the other within itself so that if we develop one we automatically have the other and vice versa. But if we represent both then we automatically have an image of the Matrix Logic.

Figure 73:

archetype of the musical scale

QUALITY TRIGRAMS

octaves



QUANTITY TRIGRAMS

kinds of numbers

The Matrix Logic has sixteen operators that are arranged in duals. We would speculate that these are the proto-images of the qualitative and quantitative views of the octave splits of the proto-imaginaries. This leads to an interesting vision of the relation of Matrix Logic to the Laws of Form and the Laws of Pattern. The stable points of the imaginaries turn inside out and become the operators of the Matrix Logic. They appear as truth table matrices that operate on each other and truth values of relations. Of course relations are between forms or pattern elements. There are myriad relations set up within the formal and the pattern systems. All of these are subject to verification truth and the evaluation in terms of true and false. So the Matrix Logic acts as a set of constraints on relations between forms and patterns. Constraints can be internal or external constraints. The internal constraints define the stable points within the traces for the structural system. These stable points differentiate producing the layers of the special systems. Ultimately there are two sets of stable points; one for quality and the other for quantity that are duals of each other and appear as images of the octaves. These

points projected from the inside of the formal and patterning systems become external constraints on the reflection of that system within itself and between its duals. This reflection appears as the duality between operator and operand at the level of Matrix Logic. Matrix Logic operators are combinations of truth vectors. Truth vectors contain truth scalars. What we see here is that truth is itself broken into discontinuous quantities that are concatenated. This hierarchy goes from scalars to truth vectors to logical operations to hyperlogical operators. These are higher and higher logical levels of external constraint on the relations within the patterns and the forms at the next higher logical typed system where the Laws of Form and the Laws of Pattern are perched. To the extent the Matrix Logic represents the external constraints the “both” and “neither” truth values come into play whereas to the extent the Matrix Logic decomposes into the Laws of Form and the Laws of Pattern then the proto-imaginaries that represent internal constraints comes into play. The differentiation of the proto-imaginaries gives us an image of these internal constraints that manifest at the trace level. These images correspond to the dual logical operations at the Matrix Logic level.

Figure 74:

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meta-level 2 --- Matrix Logic
    contextual truth 2 -1
    sixteen logical operators
    positive and negative logics
    hyper-logical operators
meta-level 1 --- Laws of Form or Laws of Pattern
    proto-imaginaries *i* and *j*
level 0 ----- Quantitative or Qualitative Systems
    Numbers                               Qualities
    N^2                                   2^N
    imaginaires                           heuristics
    complex                               bigrams
    quaternion                            quatragrams
    octave                                trigrams
meta-level -1 --- Magician systems
    
```

In order to get a complete picture we need to not just produce the series of stages of GST and the special systems but we must consider these from the qualitative and quantitative perspectives and must construct both formal and patterning formalisms within the context of the Matrix Logic.

12. Building Minimal Social Machines

Given that this is all quite difficult to imagine we will step back toward computing and begin to relate it to a concrete computational system called Spatial Machines. Spatial machines are described by Yosee Feldman and Ehud Shapiro (Communications of ACM, Oct 1992, V35#10, pp. 61-73). These are computing machines that inhabit three dimensional space and use light streams as tapes. They can move in three dimensional space and emit and receive flying bits in all three dimensions. This model has been described in a previous paper by the author in connection with the definition of minimal social machines. Here we wish to note how this unique computational model which attempts to make more realistic the models of parallel processing can be seen in the context of our argument concerning laws of form and pattern as well as Matrix Logic. We note that these machines can use reflectors to set up light tapes that use space as a storage medium. These same tapes can be turned into communication channels in a distributed artificial intelligence system in order to define minimal social machines embedded in spacetime. We can then begin to study the protocols for coordination between these minimal social machines by which they accomplish computational tasks together than none of them could do separately.

We go on to speculate that the symbols of the tapes that are used for the symbolic interaction of the minimal social machines could be based on pattern and formal systems such as we have been describing and their operations based on hyper-Matrix Logic. Lets think a little about how this would work. A tape is a form which is composed of places within which values are placed. No one has questioned this original formulation by Turing. But is it not clear that the tape can be considered as a space split by distinctions so that we could just as well use the Laws of Form as the means of constructing the tape. This would mean that there would be a single symbol that would demark the tape into a hierarchy of subspaces as opposed to the blank tape. The expressions on the tape would have form when considered in relation to the background of the blank tape. At any arbitrary level we could transform these expressions into content using the primary arithmetic which would yield marked or blank as a final value. Above that arbitrary level we could use the formal calculus to manipulate the expressions on the tape that contained these values. So far it is easy to see how Spencer-Brown's formalism could become the means of manipulating values and memory locations of the tape. Since his formalism is equivalent to Boolean Algebra we can do this and remain on fairly firm computational ground. The turning machine itself would operate on these expressions using the same formalism acting as a theorem prover. By concentrating on the values of expressions it could transfer data but by

manipulating expressions it could reformat the tape. Thus the format of the tape would be seen to carry information actively and not just passively. Now the tape that is divided into memory locations with content can also be seen as containing a pattern. The pattern is the totality of the information stored and its active format. In fact if we want to read the pattern we need to reverse our axioms in the Laws of Form to those of the Laws of Pattern. In those new axioms repetition produces blanks and crossing/recrossing produce marks. We can see in these axioms the actions of reading and writing. In other words as we cross repeated contents we interpret them as blanks but where we cross and then recross lines we interpret them as marks on the tape. Or by crossing/recrossing we make a mark and by repeating the identical we produce blanks of the tape. Another way of saying this is that when we cross repeated values we see nothing but when we bump into something new we take that to be a mark. The Laws of Pattern can be seen as distinguishing lower level difference from differences that make a difference. We must remember in Laws of Form this information is two dimensional so that reading the tape just in one direction is not enough. We must in effect make a 90 degree turn and march to the edge of the tape after every crossing in order to see how deeply nested the spaces really are. Writing is just the opposite of reading. As long as the mark is repeated then no mark is made on the tape but when a mark is nested or recrossed then a mark is made on the tape. In this way we see how reading and writing operations are generated by reversing the interpretation of the marks from the Laws of Form to the Laws of Pattern formalisms. We see then that the tape can be seen as either a pattern or as values within a format. We note that this reversal that produces reading and writing out of formatted data values occurs again within the turing machine. In the turing machine the input values are compared to state information to produce new states and actions. State machines are normally used to represent this kind self-directed action and other-directed action. We notice that there is a meta-level difference between read and write operations and operations that select actions and states. We can see the state machine within the turing machine as being a way of implementing the recursion of the Spencer-Brown formalism back into itself. Symbols that represent Spencer-Brown expressions are read from the tape. These represent the value at the particular formatted location. The state machine state can be seen as a pointer to the formatted location. The current state is associated with a target state that can be seen as a pointer to a new place on the tape. When the action can be to move the state machine, move the tape, read, write, evaluate, change state table values, test, or manipulate values. This is a pattern of behavior. Behavior is different from information. For behavior repetition means no change. It is only when reversibility occurs that change can

happen because it takes supplementary actions to make reversibility possible. Thus for behavior reversibility or the crossing and recrossing equals a differentiable distinguishing mark. One kind of distinguishing mark is a symbol written to the tape. But there are different kinds of distinguishing marks between behaviors that are not reducible to pure information but are existentially different.

We would represent this new meta-level by the Matrix Logic which combines ordering and formation in the same logical system. The state machine itself is an ordering of vectors with internal dependence. When values come in from the tape as patterns we need to reinterpret them as forms take them out of the patterning introduced by reading and writing. Thus we compare them to a new formatted set of values called the state machine table of state machine vectors. We could use the Laws of Form formalism to create this internal list of events, input states, output states and actions. In fact we can see clearly that there is no reason for the format of this table not to be manipulated like the format of the tape. Except in this instance there are four parallel tapes with expressions that are parallel instead of a long single strand of tape. But as long as it is segmented into four parallel formatted sub-tapes we can see it as merely a set of values within places that can be represented just as easily with the Laws of Form notation with the added value that the format and the values can be manipulated. The output of this table is actions which can be the operations of Matrix Logic or hyper-Matrix Logic or other actions as we see fit to give ourselves when we construct our processor. Actions include moving the tape backward and forward or in the case of light waiting the proscribed delays to access different parts of the moving memory. In the case of Spatial machines it also includes moves of the processor in the Cartesian coordinates of space. We would posit that these operations are again patterns of behavior and so that there is another transformation between form and pattern here that we must take note of as information goes back on the tape, is manipulated by logical operations or leads to processor movement.

Essential to the construction of the processor is two registers besides the Matrix Logic and other behavioral operations. These are the accumulator and the index register. The index register points at memory locations from which things are brought into the accumulator. The index register is for pointing at information and the accumulator is for grasping and manipulating information. These two kinds of register each are based on a different kind of Being related to Heidegger's present-at-hand (pointing) and ready-to-hand (grasping). We note that the software which resides on the tape has Hyper Being as its kind of Being as opposed to the Pure

Presence of the present-at-hand and the Process Being of the ready-to-hand. This leads us to realize that the tape is the recording of the action of the turing machine as traces. In fact in a universal turing machine the list of state vectors can be written to tape itself and then read in to create particular kind of turing machine on any processor. This is a confirmation that we are dealing with traces at the level of Hyper Being when we are dealing with the information stored on the tape. We see the process of writing the turing machine to tape itself as the same process of encoding into traces that we spoke of earlier. As traces it is frozen but by manipulating the frozen image we can transform one turing machine written to tape into another one with yet another software program. This is the basis of the transformation approach to software development. It sees each level in the development of software as a dataset to be transformed into another dataset. Each transformation is at a meta-level from the last one in an indefinite series of transformations using different meta-languages. So we see here that conversion of the turing machine into traces is actually a practical exercise within the domain of computation. There software embodies the characteristics of DifferAnce. And we see in action the conversion of forms and diacritics into traces patterns so that they might be transformed into other formal and diacritical systems.

It is clear that form and pattern and the switching back and forth between them play a role in the computing machine and we can also see the value of logic within that context. It is logic that allows us to test for conditions and then guide our actions based on those conditions among relations.

Now let us think about what happens when we combine the tape that is formatted using Laws of Form and the state vector table within the processor using the same formalism. In effect we get a cellular automata of a peculiar kind. Think of taking a Spencer-Brown expression along one direction and combining it with another such expression in an orthogonal dimension. This in effect is what is occurring when we combine the tape and the state vector table. We get nesting in two dimensions of marks and we get crossings in two dimensions. This creates a field of cellular automata which are then activated by two sets of tunneling programs to produce the temporality of differAnce. These cellular automata are not necessarily fully connected to neighbors but might be connected to any other automata in the field. And the rules of these automata may be different for different subsets. The two different timing sequences that represent recursion are likely to conflict. But this is why we have the patterning dual formalism. Through patterning which is the state value field of the cellular automata it is possible for these disparate and broken

field of machines to coordinate and communicate in order to produce results. Thus when we look at cellular automata they have the surface of visible states that form a global pattern and the global rules. In these Brownian cellular automata systems there is not global rules but instead the recursion system, and there is no global grid but only the layers of marks. Through tunneling any automata can be connected to any other one. So we see that spatial machines can be transformed into Brownian Cellular automata where processors run recursion routines at the trace level embodying differing and deferring.

Within such a bizarre cellular automata system we see how the stable points articulate levels of congruence between form and pattern. We can think of the two combined Spencer-Brown expressions as occurring on a mobius strip. Such a strip has one edge and one side globally while it has two of each locally. We can write the two expressions as if they were in fact one expression which interacts with itself along the edge at every point. On one side of the mobius strip is the tape and on the other side is the encoded state machine which globally become a single expression of distinctions. The execution of the mobius computer would occur along the edge as we jump back and forth by tunneling between memory locations as directed by the state machine. Such a mobius computing device would continuously be rewriting its own state machine due to the blur in the distinction between data and program. The tunneling gotos which represent difference occurs along the edge of the mobius strip. And this tunneling embodiment of time as difference would produce the two proto-imaginaries that Spencer-Brown speaks of which really micro-delays in entrained wave forms. These two proto-imaginaries become real and imaginary numeric values held in conjunction at the level where quantity splits from quality. As we add other computational mobius strips to this one we generate the higher and higher algebras that emulate autopoietic and reflexive systems.

In this way we would create a mobius landscape from our bizarre two dimensional cellular automata configuration. We notice that jumping in time occurs along the edge. This gives us a configuration at the level of complex numbers. When we combine this computational mobius strip with another one we move to the level of quaternions and create a kliebian bottle. At this point we lose the edge and thus have no reference point to keep us from getting lost in the differing and deferring. At this level we have two proto-imaginaries which become the real and three imaginaries of the quaternions when quality splits from quantity. This is the level where autopoiesis occurs. We note that at this level we actually have four independent proto-imaginaries and four independent time streams that are

autonomous. Each computational mobius strip has two independent time streams associated with each Laws of Form expression that has been concatenated into single mobius strip surface. When we move up one more level to the meta-klienian bottle we combine four computational mobius strips or two autopoietic systems into a reflexive social system. At this level there are eight proto-imaginaries and eight independent time streams. This is the level of the social because at this level the two autopoietic systems can mirror each other and form a single resonant unity which transcends the individuals that form the unity. What is remarkable is that this emergent level is gained by merely adding the two autopoietic machines together, that is by holding them in conjunction. The eight independent proto-imaginaries and the eight time lines that are associated with them can be seen in terms of quantity as the octaves or in terms of quality as the trigrams of qualitative states. Thus we have produced a picture of how we can create a computational image of the three special systems stages step at a time. This image does not depend on the split between quantity and quality but can be seen to exist prior to this split so that we are talking about proto-imaginaries rather than numerical imaginaries or qualitative imaginaries. And what are proto-imaginaries? According to Kauffman they are delay mechanisms that hold constant as long as something else holds constant and releases slightly after that which they depend upon releases. When we consider that social systems are entrained and resonant sets of individuals we see that the imaginaries are the slight delays in entrainments which occur when a specific global stationary point is released. As Kauffman said to me in a private communication this can be thought of as the delay between noticing something and actually perceiving it in a world that co-arises with oneself. Thus there are delays between co-arising things in their interaction. The imaginaries make these delays vanish. This takes us back to our theory of time introduced by Ivar Johansson where he noticed that in order to solve the problem of time we must think of time going backwards and then being processed forward at each instant. This solves the problem of how things that are autonomous can become entrained so that they do not notice the time difference between them necessary for communication. This point was explored in detail in the first part of On The Social Construction Of Emergent Worlds. Here we see the proto-imaginary numbers as the points of reversibility between time going forward and time going backwards. The delays that naturally occur between co-arising autonomous phenomena are hidden in these proto-imaginary points so that the unavoidable delays cannot be seen by them. They appear to be completely resonant with each other from each ones point of view. But this is an illusion that is supported by the reversibility of time where each is processing time backward and then projecting it forward in the instant in order to

keep the illusion of perfect harmony going as a sustained illusory continuity. This illusory continuity is shot through and through with discontinuities in this case with the discontinuities between the eight proto-imaginaries and the eight independent time streams that are necessary to keep the illusion in tact at the social level. At the level of the autopoietic system there are only four proto-imaginary out of time delays necessary to keep this illusion afloat. Within the computational model of the dissipative system simulated by the computational mobius strip there is only two proto-imaginary delays necessary and only two time streams. There is a reversibility between proto imaginaries and time streams. Thus at the social level we actually have sixteen duals matched to the sixteen operations of Matrix Logic. At the quaternion level we have eight duals and at the complex number we have four duals. The proto-imaginaries represent the current value of the delay and its opposite. If we look at the totality of values over time as Kauffman and Varela did then we get the dual time stream. But in the case of the proto-imaginaries we are talking about the hidden values of stationary points held constant by the configuration of other points in the system. Those values represent the reversibility between time moving forward and moving backward within the system. To create the specious present we must compute backward and then project the gloss of the backward computation forward as the current value. This is the reverse of Husserl and Heidegger's internal structure of time that sees values fade as they are pushed down on top of other values over time. We read that stack backwards and project the gloss of that forward as our summation of the next instant. When two computational mobius strips do that we have an autopoietic system. When four computational mobius strips or two autopoietic systems do that we have a reflexive social system. In such a system there is apparent immediate mirroring of a response from one entrained autonomous agent to the other. But this immediate response of agents that are in reciprocal complementary entrainment is an illusion that must be created in a way that bridges over the differences in time caused by communication delays that cannot be escaped. It means that each must be projecting what the other will do in the next instant based on a review of what happened in the last series of specious presents. Both are reviewing what happened and projecting each from his own history what the other should do and what his response should be. They both project at about the same time and if they guess correctly the we get apparent reciprocal action that appears entrained. All the communication delays are hidden by the dependent co-arising of mutual projection. All the backward analysis of previous mutual history to come up with the current projection is also hidden. What we see on the surface of the interaction is the resonance and harmony of the autonomous agents or within an agent between its different dissipative systems or

within a dissipative system between its independent time streams of different order producing sub-systems. The delays folded into the fabric of time as Difference made possible by its nature of differing and deferring become invisible in the maintenance of wider and wider promulgation of the illusion of continuity across multiple dissipative systems or multiple autonomous living/cognitive creatures. Once it is possible to entrain two autopoietic systems then it becomes possible to maintain this entrainment across any number of them and create societies as bearers of large scale illusions of continuity called systems, meta-systems, domains, worlds, universes and pluriverses depending on the depth of involvement in the projected illusory continuity.

There is an undecidability whether the mobius strips are combined into the kleinian bottle. There is also an undecidability whether the two kleinian bottles are combined into the meta-kleinian bottle. This undecidability at each stage is the place where the emergent characteristics of each level open out. Through this vision we can see how a computational image of the layering of the special systems might be created using the Spencer-Brown Laws of Form as a basis. In this we see that the turing machine may be imagined to be a computational mobius strip with the tape on one side and the state vector list on the other and using the Laws of Form formalism as the means of designating the computational structures. When we create the computational mobius strip we have a single turing machine equivalent that can model a dissipative system. This is because two recursive tunneling structures occurs at the edge of the computational mobius strip and these activation structures can be seen as control orders that are related to each other like the ordering principles within dissipative systems. When we move on from there to producing the computational kleinian bottle then we get the combination of two turing machines into a single meta-structure that is equivalent to two orders of cellular automata combined into a single edgeless surface. We can see these two orders as covering each side of the bottle. Thus the two orders merge into a single computational surface that is locally differentiated into sides. The neck of this bottle passes through the surface in three dimensions. Thus the surface is self-interfering. This self-interference can be seen as the point where the surface orders itself -- coming at itself from nowhere. In four dimensional space the Kleinian bottle can be constructed such that it does not interfere with itself. So self-interfering can be turned off so that only the contrast between states on either side of the bottle surface remain. So there are four states of the computational system at this level: separate computational mobius strips, mobius strips joined to produce the pentahedron, mobius strips merged to produce the computational kleinian bottle

which is self-interfering, and mobius strips joined to produce a computational kleinian bottle that is not self-interfering. These are the four modes of the autopoietic system each showing a higher degree of fusion and unity. From there we can go on to consider what happens when you combine two autopoietic systems in the meta-kleinian computational bottle at the social level.

13. Laws of Pattern

The pattern language that is the dual of the Laws of Form is trivial in comparison to the formalism developed by Spencer-Brown. This is probably why he ignored it. Louis Kaufman said in a private communication that he had dropped studying it because he considered it uninteresting. However, the Laws of Pattern must be seen together with the Laws of Form formalism as a necessary whole. Therefore we will develop the Laws of Pattern here in order to give some flavor of this necessary dual formalism.

// = repetition equals groundstate

\\ = / cross-recross equals mark

Louis Kaufman says the result of this is a formalism that is indifferent to its interior. For instance if we have two circles next to each other then this is the same as having no circle at all. If they are within a circle that is just the same as having only one circle -- the outer one. If one circle is within the other then that too is the same as having only one circle -- again the outer one. Indifference to insides is exactly what we would expect with pattern. Pattern is completely on the surface of the form. It is only form that creates depth of nesting. But what we trade for depth we gain in our ability to recognize order. The two axioms serve as recognizers or writers of marks or blanks that may be used to read patterns or order them. So for instance if we want to write a series of marks we must feed the writer a series of marks as long as we want it to not write anything and then when we want it to write something we reverse across a mark in order to create a difference that makes a difference which appears as a mark. This means that a pattern writer inverts the meaning of marks across the boundary of the writing device. If we want to read a pattern then we give a zero as long as there is a repetition of content but when that repetition changes and we react to the change then we will read a marker that stands for a difference that makes a difference in the ordering that is read. Notice that the inversion that we are talking about causes us to cross the boundaries from one logical type to another. The highest logical type is the ground state and we refine that into a meta-level by introducing marks. But as long as we are repeating those marks then we do not

distinguish anything. It is only when we move to the next level of logical typing from the mark to the process that we introduce a distinction at the next lower level of logical typing. Louis Kaufman says that the cross-recross is equivalent to the *XOR* by which we would recognize things in Boolean algebra. The cross-recross equals mark axiom is the recognizer and the repetition equals groundstate is the ignoreer. Or we could say writer and don't write. Either way we need both in order to do anything interesting with the Laws of Form. They are the door to operationalizing the Laws of Form. But they do that by ignoring their insides and that is because they write patterns only on the surface of forms. We can interpret those patterns as nested forms but we should distinguish between those interpretations because patterns are not the same as forms. For instance there is in the example of the string of ones and zeros. The ones and zeros are the pattern within the form of the string. Our rules could write ones and zeros and we could interpret them as configurations of marks, crosses, and blanks and thus see in them the Laws of Form formalism but there is really no depth in the ones and zeros themselves. Form only appears when there is depth as Spencer-Brown aptly points out. Thus the one dimensionality of the Laws of Pattern specifically locks into a superficial space on the surface of things where patterns reside as glosses on orderings of content. We see the content as marks that are turned on or turned off in configurations that blend to produce more and more complex orderings. This points us to structuralism that always reduces to binary differences between categories of content that are concatenated to form complex structures. In this realm content is repeated to form homogeneous patches within the ordering and content is varied to produce variety. What we lose in depth we gain in the opening up of the structural level within form which is also the same as the semiotic level and the diacritical level. All repetitions are seen against the groundstate of global diacriticality and all differences that make a difference are seen against repetition. These three elements (global diacriticality, repetition, and difference that makes a difference) are the basis for understanding all orders. Orders must be understood in relation to other orders within the same form. Does the order fill the groundstate and thus become a global ordering or does it coexist with other orders in which case there exist differences that make a difference that create margins between orders and allow them to be distinguished. Finally there are repetitions of orders to create meta-patterns within the patterns that in turn produce second order significant differences and so on as different gestalts are built up. This kaleidoscope of patterns really only becomes dynamic when we add Goertzel's operators which allow patterns to cancel each other out, to act on one another, and form gestalt joins. Think of magicians as dynamic patterns that live inside the structural/semiotic level rather than as forms.

Think of them crossing trace boundaries where annihilation takes place regularly. They inhabit a world which is always on the surface of things but which is orthogonal to form stretching into the semiotic so that they arch over the abode of traces. Because they need to continually cross the discontinuities created by traces they cannot have continuous processes. They thrive in the flattened out space where everything has been reduced to information and algorithms that are themselves reduced to information. Forms need dimensional space whereas magicians can inhabit texts alone. They create patterns like those flickering light signs in Times Square in New York directly within the content flattened into information. The magician system is what gives depth to the Laws of Pattern. The Laws of Pattern itself lacks all depth. But the magician system takes the content and patterns it in such a way that takes account of the possibility of traces beyond the semiotic level and even takes into account the propensities of Wild Being. Thus what appears flat and without interest becomes very interesting as soon as we realize that beyond diacriticality and semiotics is the level of traces and beyond that the level of no trace which all appears mirrored in the content entrapped within the form that Spencer-Brown ignores. By saying that a name is the same as the thing named he closes the door to the structural/semiotic layer that actually exists on the surface of the form not at its depth.

14. General Magicians Theory

We shall begin by making the assumption that all magicians in a magicians system are themselves composed of swarms of magicians. This conforms with the general thesis of reflexivity which says that external relations of a social system mirror the internal relations of the reflexive system. The swarms of magicians operate within the flattened semiotic space on the surface of form. They connect the Semiotic level to the Trace and No-Trace levels of content of forms. In doing so they provide a mechanism to translate content across the breaks in patterns. They also allow us to find those imaginary fixed points that these transformations revolve around. And they give us a picture of the pure variety production of Wild Being. GST describes Forms and their structuralized content. But structuralization is merely the formation of mini-formalisms to order content. Magician systems do the same thing -- ordering content -- but without creating the same micro-formalism based on the assumption of continuity. We do not even have the continuity of process over time signified by Spencer-Brown's cross-recross mechanism. Instead at most we have only time as the differing and deferring of DifferAnce. Magicians are ordering mechanisms for content that operate at the sign, trace and no-trace levels within the

illusory continuity of ideation. They are not forms. So we can see why they came to the forefront for Goertzel when he radically reduced Form to Pattern reversing the normal bias toward formalisms over ordering devices.

This crucial understanding of the nature of magician mechanisms allows us to construct a general theory based on everything we have said in the foregoing. We would be making a mistake to model magician systems as if they were forms. Forms have nesting and depth even if written on a plane. General Systems Theory describes forms and their ordering by which dynamic systems can be modeled. But when we move from General Systems Theory to the special systems we move to a flat world in which information is encoded and embedded. That flattening takes a series of stages which we associate with the different special systems and which is differentiated by the recognition of more and more complex congruency relations and by the appearance of more and more fixed points at the trace level where forms disappear into potentia. We can see forms arising out of the plane of potentia and going through their epigenesis only to fade back into it again at the end. So we can think of the action of magician systems as taking place directly on the surface of the unconscious with the firsts that arise from the unconscious as contents. As such the magician systems are the pivots between the symmetry of the unconscious and the asymmetry of the conscious. We can see that because with them symmetry gradually breaks down step by step. First the inverting twist of the complex numbers intervenes and then we lose the ability to reverse actions to return to where we were and then we lose the ability to rely on associations. As we do so we move away from symmetry but only in the surface of the firsts which are arising. As yet no forms are produced by the build up of GST with the advent of the different orderings. Not even any viewpoints that might take us away from the plane of the unconscious have arisen such as the Functional or the Agent viewpoints. All that exists is the Catalyst viewpoints that is all encompassing and directly oriented toward seeing only firsts alone. So if we think of general magician systems as operating in the plane of the manifestation of the unconscious contents as firsts and GST as handling anything that arises out of that plane then we can understand why magician systems have not been noticed before. We are normally not looking directly at flat unconscious contents as pure patterns. But if we did we would see that they are described precisely by magician systems and their three operators. The annihilation operators describe the orthogonal discontinuities between contents arising from the unconscious. The action operators describe disjointed actions of individual magicians as they attempt to regain symmetry at the level of the autopoietic system. The gestalt operator sets up associations between

the contents forming gestalts. It is these gestalts we see in our fantasies or dreams as configurations of contents that are recognizable. But it is only when you start adding ordering to the contents that we can begin to build up forms and understand their dynamics structurally. The gestalts may be metonymical and not therefore ordered. It is ordered gestalts that become forms and are understood structurally.

What does this mean? It means that the surface of the unconscious can be seen from the point of view of a dissipative system, or an autopoietic system, or at last as a social reflexive system. And this makes sense too. We know that the unconscious is the domain of symmetry which is very strong ordering. It is ordering contents so strongly as to make them invisible. But we also know that there is a hidden counter ordering which we generally associate with the unconscious where it creates divergences in the pattern of the contents of consciousness. This is what we normally think of as the unconscious -- as a source of disturbance or counter ordering to the normal ordering of the asymmetries of consciousness. And we associate this with what Henry calls the Essence of Manifestation, or pure immanence that can only be seen by its disturbing side effects in manifestation. This is equivalent to the notion of the ID or the individual unconscious that causes forgetfulness, strange associations, dreams, and other contra-ordered psychic phenomena. We will note that the autopoietic system is closed and exhibits some of these same effects that the unconscious exhibits. When we create an autopoietic unity we are creating along with it its unconscious which means its hidden aspect that no observer can have access to. These unconscious aspects can only appear in behavior. By definition anything that appears in relation to cognition is conscious. So it is the disparity between action, even imaging action or the action of speaking that inconsistencies arise that reveal the individuated unconscious. But we can go on to the social level and see how at that level the intersubjective or collective unconscious arises as the hidden aspect of the social group. We see the collective unconscious in the actions of groups. So we see it when we combine actions with associations. So when we look at the surface of the unconscious itself we see that it can be seen in terms of ordering and disordering, in terms of asymmetrical action, or in terms of associations and a level of the unconscious is associated with each.

If we consider the surface of the unconscious as a whole we see that it has patches where contents are rising and falling. All those patches are orthogonal to each other and they represent some asymmetry with in consciousness either opening up or closing. For each patch we can imagine an ordering principle enacted by some magician system inhabiting the surface of the unconscious itself. When we

consider the competition of the ordering principles they appear as dissipative systems that Deleuze and Guattari call Desiring Machines. At the dissipative level the desiring machine might correspond to a part of the body or some other obsessional partial object. However, we might see those ordering systems in relation to the actions they produce in which case they are seen as the mechanism of the machine rather than in terms of the content that is the focus for the machine. At such a level many minds appear as inhabiting the surface of the unconscious. But the many minds form a society of the mind that exemplifies many features of the social like emergence. The unconscious is the place from which new things come par excellence. It is the society of the mind that provides the underlying imaginary continuity for consciousness. But if we dive through the surface of the unconscious we realize that it is the access point to many consciousnesses because it is in reality the overlapping of the unconscious of many individuals from the same society. Thus it is as if the social unconscious were a tunneling point from individual to individual from within them all. As such it provides the basis of all the individuals and the society which they make up as well. Thus the unconscious can be seen as the reflexive point at which all the individuals within a society mirror each other internally and externally. When any of us looks at another from our society we are looking at the face of the collective unconscious and when we look within ourselves we see at our depths everybody else within our society as a many headed monster like Scylla or the Hydra. Our every word and action must be negotiated in relation to this internal representation of everyone. This dance with many partners goes on many times unconsciously but sometimes consciously in relation to the idea of the “Generalized Other” as G.H. Mead would say.

The concept that magician systems inhabit the surface of the unconscious and not the conscious realm itself has interesting repercussions. It tells us that magician systems are useless on their own without some kind of GST formalism to create their backdrop. But it tells us that by adding Magician systems to our GST models we are adding a formalism that is capable of modeling the unconscious in its various depths. Thus though it operates on the surface it projects a deeper depth than the formal system can do alone. In fact from the point of view of the magician system the formal system is merely the surface of things and the magician system shows us a way to model the deeper aspects of manifestation. But the two surfaces are orthogonal so if you are looking at form you do not see the patterns of content arising as firsts from the unconscious. This is one of the reasons that it has taken so long for magician systems to arise and be formalized as the dual to GST.

Instead of thinking of the unconscious it is possible to formulate the position of the Magician systems in terms of paradoxicality instead. We can see that GST formulates non-paradoxical images of systems which attempt to isolate themselves from paradoxicality. Paradoxicality can be seen as a vortex that once we enter we cannot easily extricate ourselves. We can see magician systems as inhabiting the surface of that vortex of paradoxicality instead of the surface of the unconscious. The development of the special systems attempt to constrain that vortex and yet get as close as possible without falling into it and getting lost. Dissipative systems allow us to look at the boundary of paradoxicality as a boundary with radical disorder that is incomprehensible. Russel attempted to erase paradoxicality via his theory of logical types. His attempt merely allows us to define it more rigorously but does not rid our universe of discourse of that possibility. Autopoietic systems even more rigorously constrain and define the paradoxes surrounding the definition of life and cognition. And finally the Reflexive systems allow us to constrain and define it further with the concept of the social and the emergent. In constraining and defining the paradoxicality further and further we produce a model of paradoxicality within our universe of discourse that we can live with. But ultimately that means converting some paradoxes into theories that mirror the structure of those paradoxes. Autopoiesis and Reflexive theories play this role. By learning to live with paradox but by avoiding falling completely into it we follow a middle route that accepts the limits of reason. The center of the vortex of paradoxicality is the unthinkable, the enigmatic without an answer. This has been interpreted in our series of meta-levels of Being as what lies beyond the fourth meta-level where meta-level five should be but isn't --- that is non-experiential and non-conceptual emptiness. As we define paradoxicality closer and closer we rise through the meta-levels of Being toward emptiness. As we do that we realize that the vortex of paradoxicality is maintained by ideation and is in fact when ideation attempts to turn back on itself. That is the definition of Ontological Monism -- transcendence attempting to ground itself. Ideation is composed of Form plus Sign plus Trace plus No-Trace. Thus when Ideation turns back in on itself these strata each become like mobius strips in their attempt to bootstrap themselves within the heart of the vortex of paradoxicality. In that process they begin producing imaginary values which allow paradox to stand within illusory continuity. So when we step toward the center of the vortex of paradox we necessarily move through the levels where form attempts to ground itself as it does within Spencer-Brown's Laws of Form, then at the structural-semiotic level content attempts to ground itself, and finally at the level of traces or the wave-like image of form traces attempt to ground themselves. Finally beyond cancellation this self-grounding falls apart and that is

when the level of Wild Being has been attained. Beyond Wild Being is only Emptiness. Within the surface of the vortex of paradoxicality we can see magician systems as the progressive means of modeling the paradoxical relations between signs, traces and the lack of traces. Magician systems do not assume continuity so they have no problem modeling the kind of nonsequitor jumps that express paradoxicality. Magician rules can be completely paradoxical without being wrong because they do not assume there are any continuities to be preserved. Continuity production is a side-effect in some cases not an assumption or prerequisite in magician systems. Therefore paradoxical magician systems are one natural class of these kinds of systems. Self-contradictions in fact must be produced in order for annihilations to occur within the magician systems. But these systems also model non-commutative mutual actions of asymmetries and also the non-associative metonymical gestalts. It models these aspects of paradoxicality: not just self-cancelling contradiction, but also disjoint incomprehensible actions and impossible associations. In other words it produces a deeper and deeper model of the paradoxicality excluded from form and extends form to the level of signs, traces, and lack of any traces in order to attempt to allow theory to resolve or at least live with paradox without self-destruction. Ultimately paradox is a wild and untamable sickness of thought unwisely thinking itself (reflexion) instead of stopping thought (reflection). We can attempt to learn to ride this wild tornado of involuting thought but ultimately self-destruction lies in this direction. Ontological Monism -- Transcendence grounding itself is an impossibility. It explodes into the Process of Transcendence which then reveals behind the scenes the Essence of Manifestation (Ontological Dualism) and finally splinters into a million pieces at the level of Wild Being in which a myriad local ontologies arise and compete and where immanence and transcendence are mixed and become undifferentiated. As we focus in layer by layer on the surface of paradoxicality, realizing that it is the embodiment of the limit of the Clearing in Being, that is the boundary of our world, we see that it is the special systems theories that allow us to define this ungraspable boundary ever more closely and carefully. The first stage of paradoxicality has to do with order and thus fits our models of the dissipative system, the second stage of paradoxicality has to do with action and so fits our models of the autopoietic system, and the third stage of paradox has to do with association and thus fits our models of the social reflexive system. In other words we first see that paradoxicality leads to antinomies as Kant realized in his Critique Of Pure Reason. But if we look beyond Antinomies we find that paradox also deals with displacements that are counter-intuitive that can be seen in terms of action and in fact rotations. These can be seen as the strange rotations that define the dialectic,

rotations through higher dimensions that allow the different to become the same and vice versa such as appear in Hegel's philosophy and serve to define absolute reason as the reason within the concrete things rather than the reason of the antinomies. And finally once we get beyond the rotations we realize that most paradox can be reduced to reflections and mirrorings that are seen without action and that distort things mirrored and their relations. Beyond that is incomprehensible complexity, non-computability and chaos which eventually leads to the formulation of the unthinkable. Each of our special systems allows us to zero in on an aspect of paradox and define it more and more closely before we lose control completely, before things get out of hand. As we zero in on paradox we realize that new things come into existence through paradox. In fact we recognize that all genuine emergences must go through all four meta-levels of Being as they enter our world from out of the Void. These meta-levels of Being define progressively the ultimate paradoxicality of the *utterly new* within the Western worldview. All other paradoxes between existing things must be subsumed into the paradox between Being in all its kinds and Non-Being. The levels of Being allow us to define this ultimate paradoxicality in successive states. When we consider a form that exists then we can see it related step by step to this ultimate paradoxicality of its emergence as a *completely new thing*. In these steps the levels of the sign and the trace appear. And within traces there are definite levels where configurations of imaginaries are produced which define the thresholds of complexity of the special systems. These levels of complexity of trace patterns allow us to define paradoxicality closer and closer before we lose control completely and fall into the vortex that spirals around the void.

15. Conclusion

This paper makes some major advances in the conceptualization of the Special Systems in relation to the General Systems Theory (GST). First we build up GST by introducing orders of different kinds one step at a time. Then we find that the Magician Systems proposed by Goertzel has some precedence in the work on the mathematics of pattern by Grenander. Magician systems themselves are the orthogonal dual to General Systems Theory. They encompass all three levels of Special Systems having operations that exhibit the emergent properties of these systems. We also find that the analogies proposed in the first part of this series of essays between hypercomplex algebras and the three kinds of special systems: dissipative, autopoietic and social occur because there are a species of proto-imaginary values that arise at the trace meta-level which serve as stationary points

for symmetries at the meta-levels of sign and form. Understanding the relation between these proto-imaginaries and the numerical imaginaries allows us to see how the existence of the analogies point to a deeper correspondence between systems of all types that operates at this meta-level of Being called Hyper Being. This correspondence has been discovered by a study of Spencer-Brown's Laws of Form to which we have found a dual Laws of Pattern formalism which demonstrates the complementarity of the Form to Pattern. August Stearn's Matrix Logic is shown to be the overarching formalism that encompasses these two formalisms and extensions to the kinds of truth beyond true and false are discovered in two orthogonal directions. Traces naturally arise as the interference between Form and Pattern ways of looking at things. In general this paper deepens and substantiates the analogies posited in the first part of this series of essays between levels of hypercomplex algebras and the special systems: dissipative, autopoietic and social/reflexive that emerge from General Systems Theory.

Reflexive Autopoietic Systems Theory

<i>prajna {Buddhism}, wisdom source of meaning</i>	traceless <i>trackless lostness</i>	difference⁵ <i>emptiness unthinkable</i>	<i>a discernment of a decision on a discrimination</i>
<i>touch touching {Merleau-Ponty} inscription in the flesh {Deleuze} chiasm {Merleau-Ponty} reversibility</i>	no trace <i>palimpsest labyrinth</i>	difference⁴ <i>Being⁴</i>	<i>a decision on a discrimination of a demarcation interference between traces what appears after cancellation of traces</i>
<i>arche-writing essence, beginning {erasure} hinge spacing</i>	trace <i>discreteness difference reserve</i>	difference³ <i>Being³</i>	<i>a discrimination of a demarcation the indenture of the line in the paper beyond the r <u>Grammatology</u>, the science of traces</i>
<i>writing/speech origin, essence, beginning formation across discontinuities</i>	sign <i>system & structure text production noesis/noema mark, code</i>	difference² <i>Being²</i>	<i>a distinguished distinction or a demarcation a difference that makes a difference {G. Bateson, relevance, significance, varieties, kinds</i>
<i>book, paragraph, sentence etc. course, rhetoric, presentation</i>	form <i>morphe letter, picture, word</i>	difference¹ <i>Being¹</i>	<i>a distinction, threshold, variation of the variation outlines of things, laws of form {G. Spencer-Brown duality, transcendence, domination</i>
<i>colors, tints, hues, tones, styles mood</i>	content <i>hyle</i>	difference⁰ <i>beings, Being⁰</i>	<i>variation, heterogeneity, undistinguished, indeter indistinct, indecisive, indiscernible, indiscriminat</i>
<i>cleared, cleaned, leveled prepared surface genocide, ethnic cleansing</i>	tablet <i>the writing surface the clean slate blank sheet hewn</i>	anti-difference <i>no difference no-thing indifference identity</i>	<i>plenum of pure difference {homogeneity = hetero suppression of variety differences that make no difference nihilistic landscape produced</i>
<i>partially ordered arranged, fitted together</i>	texture <i>rough hewn "things," garden</i>	sameness <i>social entities the They, das Mann</i>	<i>selected variety, minimal modification of what is, no excluded middle, prior to identity all things embedded in the social fabric</i>
<i>natural variety unordered, unarranged</i>	resources <i>natural complexes unhewn materials</i>	alterity <i>otherness alien</i>	<i>unsuppressed discovered unadulterated variety deep ecology</i>

TABLE 1

Reflexive Autopoietic Systems Theory

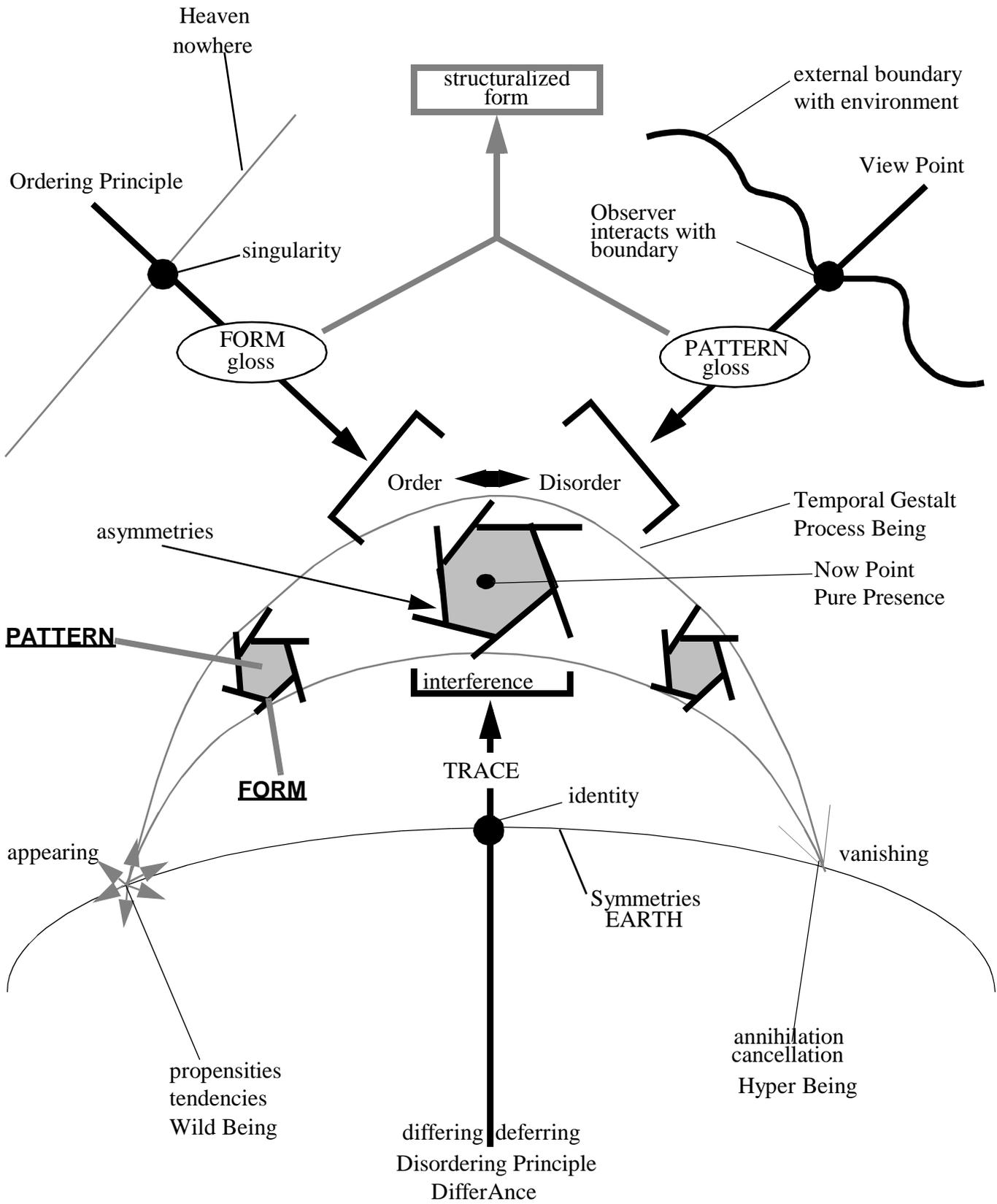
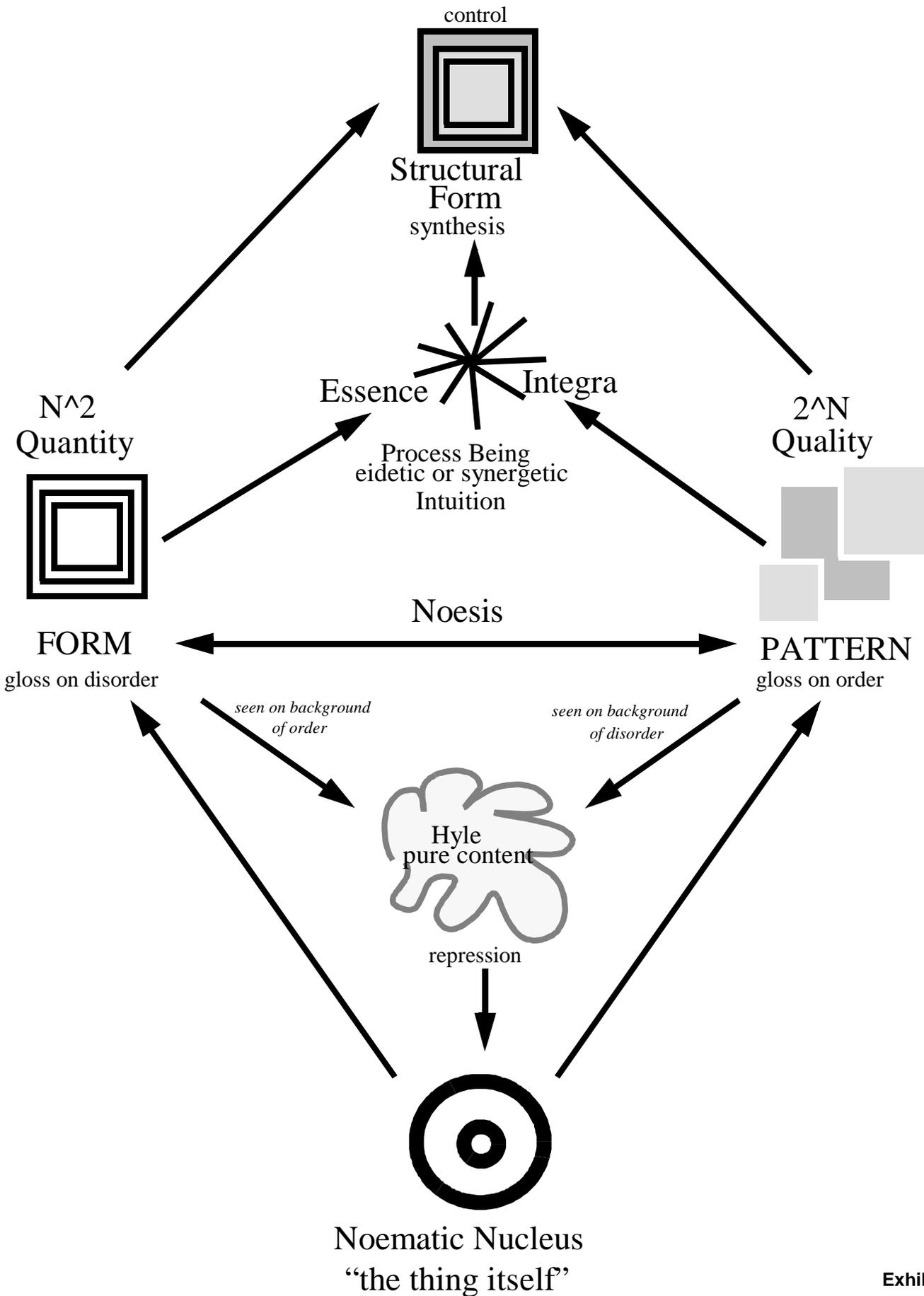


Exhibit 1

Reflexive Autopoietic Systems Theory
Idealized Formal-Structural Dynamic System



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**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, Autopoiesis, Reflexive, Social, Worlds