A Framework for Exploring General Schemas Theory

The Advance of the Systems Engineering Discipline through an extension of Systems Theory

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Introduction

In a previous paper[1] a model of the schemas that are the subject of General Schemas Theory was proposed. That model used Pascal's triangle as a way of differentiating the schemas from each other. Each schema, including Pluriverse, Kosmos, World, Domain, Meta-system, System, Form, Pattern, Monad and Facet, was said to operate on two different adjacent dimensions. Thus forms are two and three dimensional, patterns are one and two dimensiona and systems are three and four dimensional. This applied to each schema which taken together ranged from negative one to nine dimensional

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[1] See General Schemas Theory by author
http://archonic.net

in pairs. At each dimension you could decide to apply one of two dimensions to any ontic phenomena as one projected an ontology on to it. Schemas are ways of dividing up spacetime so that things can be isolated and classified. What ever emerges must take on the template of one of the schemas, and thus they represent basic templates of things that underlie understanding. We are particularly interested in them because we not only project the geometrical or mathematical schemas, as Umberto Eco calls them, on to things of our experience but we use them as the fundamental basis of design in Systems Engineering. We are trying to extend academic Systems Theory into a Schemas Theory and turn it to practical purposes as we extend Systems Engineering to Schemas Engineering.

A Central Question

In this paper the central question will be why each schema appears at two different dimensional levels in the Pascal Triangle in which dimensional unfolding of the schemas occurs. We will apply to this problem the results of Bekenstein who defined the Holographic Principle in physics. Bekenstein was studying black holes and their relation to entropy. He discovered that the entropy of a black hole was equal to one quarter of its surface area. This meant that the three dimensional structure of the black hole could be collapsed into a pattern on its two dimensional event horizon. We will consider the question of why there are two different schemas at each level of the Pascal triangle OR why there are two different dimensional images of each schema in light of the Bekenstein Holographic Principle. The Bekenstein Entropy bound is considered a rather deep result in physics and no counter example has yet been cited to this bound. It is

a bound on how much entropy can be created which limits black hole growth. Black holes are known to evaporate due to Hawking radiation. Since information is lost when things fall into black holes and the black hole keeps expanding only in mass then much information is lost in a black hole. This loss is only seen in the expansion of the surface of the black hole and the entropy of the black hole is one quarter of its surface area measured in plank units. We have already likened the surface of the black hole to the surface of an autopoietic system[2]. So this result implies that the entropy of an autopoietic system is one quarter of its surface area. By an autopoietic system we mean a living organism that maintains its viability by self-production. Heidegger's human dasein is such a creature. Dasein projects Being onto everything in the world including itself as an ecstatic projection. That projection overflows dimensionally as at a minimum the schemas projected on everything in the world and beyond the world. That projection is part of the negentropy of the autopoietic system, which is produced when two dissipative structures, ala Prigogine, form a symbiotic relation with a stationary boundary. So we can see that the production of the emergent series of schemas based on a dimensional infrastructure is negentropic, i.e. an ordering of things within the world of dasein. Thus, we can imagine that de-projection, i.e. moving down the schematic hierarchy, could be entropic. When we move from a three dimensional ball to a two dimensional representation of a ball we lose information. When we move from a pattern that represents a two dimensional figure of a ball to a one dimensional colored thread we loose even more information. The key here is

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[2] See Reflexive Autopoiesis and Weak Measurement by author http://archonic.net

to force a move to an adjacent level in the ontological hierarchy of the schemas one must go at least two dimensions toward zero dimensionality. Moving two dimensions actually makes only one quarter of the information available because the representational space is smaller with fewer degrees of freedom. But this one quarter which is left is positive information in a sparser representation. Actually three quarters of the information is lost. But that three quarters is lost by the loss of information, not necessarily its disorder. Entropy is the disorder of information. It says that one quarter of the information lost was from disordering not from the information merely vanishing. This disordering is equal to the information that is left intact. Disordering of information is a stronger phenomena than its merely vanishing. So the disordering balances what is left of the information, while half of the information bits just vanished but were not disordered in the process.

As we move from one schematic dimensional level to the next toward dimension zero we lose information through de-emergence. But de-emergence is not just losing information, but loosing the emergent properties of the higher level. This losing of the emergent properties is equal to a disordering of information not just an information loss. Because of this disordering we cannot recover the higher level emergent schema until it re-emerges with its sui generis characteristics. When we move from one schema to another after two dimensional levels half of the information is lost, one quarter is disordered, and one quarter is still left as a sparse and lacking representation of the higher dimensional reality.

A forced shift in schema level is equal to a

two dimensional shift. At such an interval one half of the information is lost, one quarter disordered so that emergence characteristics are lost, and only one quarter of the information still appears in lower dimensional representations. This kind of entropy shift is occurring at each transition from one schema to another. We have a cascade of lower and lower dimensional representations with concomitant loss of emergent properties and information. It is these losses that determine the distance of one schema from the next and how their complexity beyond their dimensionality is determined. So a system has only one quarter of the information that a meta-system has. But it has proportional to one quarter of its surface area a certain amount of entropy. The entropy prevents it from reconstructing the meta-system's characteristics. It's information loss of one half accounts for the difference between the system and the anti-system. The lost information to the system allows the construction of the anti-system's information and entropy. System and Anti-system inhabit the meta-system like two Turing machines in a Universal Turing machine. Notice that two Turing machines plus a Universal Turing machine is three Turing Machines, the other Turing Machine's worth of information is the entropy that separates the two emergent schematic levels.

We have two questions before us. The first is how each schema exists on two adjacent dimensional levels. The second is how a dimensional level contains two schemas. But the piece of information our theory gives us is that a schema change is forced on us after two dimensional level changes and that this is related to the quartering of information in representations and a quartering of the information going into entropy or the

disordering of information related to de-emergence. In order to answer our questions we must reason in reverse. In other words we need to think about how this quartering of information and entropy relates to schematic interlocking. Schemas interlock at each dimensional level. A 3d system is equal to a 3d form. But a system can express itself in 4d and a form can express itself in 2d. So if we transform between system and form or vice versa we can interchange representations at each dimensional level *without information loss[3]*. So the answer to the second question has to do with intertransformation between representations. If two did not inhabit the same dimension then that intertransformation between schematic representations would be impossible. This intertransformation between schemas without information loss is an ultra-efficacy that attempts to counteract the loss of information from using representation and from moving down the emergent levels of the schemas. Concomitantly if schemas did not exist at two levels then they could not communicate efficaciously representations between levels of the schemas. So, the schemas bring an efficacious property to counteract the information loss and entropy that goes with moving in the de-emergent direction toward zero dimension in the Pascal triangle.

This efficacious communication not only allows the communication of representations downward toward zero dimension, but it allows the communication of representations upward toward n dimensions as well. However, an upward communication brings in another element explored by Deleuze, which is repetition. Repetition is the complementary

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[3] What about the transformation at the level 2^6

dual of representation. Notice that to move up the dimensional ladder we must produce more and more information, we must quadruple the information and then de-disorganize it so that the emergent properties of the next level schema appears. This production of new sets of information is called repetition. But repetition is fundamentally different from representation. This difference has to do with the relation of the Set way of approaching things to the Mass way of approaching things. Representations are sets and Repetitions are Masses. By converting from set to mass we move from the individual different units to the identity of components that together give an emergent mass-like characteristics as they all act together. The key way to look at the repetition is to understand that it is what does not repeat. In other words repetitions are approximations to singularities that can never completely reach their goal of a compete repetition. The singularity in each case is shielded by the dis-organized information or entropy created by de-emergence. The new emergent level is an emergent event unfolding from a singularity. The unfolding from the singularity is the primal event. All other attempts to reproduce it fails, and thus are fruitless repetitions. Merely repeating the information that is left over from de-emergence will not bring back the emergent next level of the schemas back. Rather the schema must emerge from a singularity that organizes it with its emergent characteristics unique to that level. In that way the schemas are set like, because each one is different and unique. But they each function over a mass of objects of different kinds. There are many kinds of forms, kinds of patterns, kinds of systems. These set-like schemas cover the whole mass of spacetime envelopes with the same characteristics. Repetition in Deleuze gets at the difference between Set like

approaches to things, verses mass-like approaches to things. We produce Representations as we go toward zero dimension and we produce Repetitions as we go toward the n-dimension. Each schema arises from a singularity within it's meta-systemic environment. Each meta-system is four-fold including source, origin, boundary and arena. Each meta-system contains singularities and blackholes and miracles (i.e. positive feedback in the positive and negative directions) along with the negative feed back loops that produce stability in the rough seas of the meta-system. The autopoietic system is such a homeostatic structure balancing in homeostasis several variables simultaneously via a hyper-cycle. The whole cycle of the schemas is such an autopoietic ring in the sea of the masses of different kinds of objects that the various schemas are projected on. Each schematic segment of this ring arises from a singularity that appears out of the disordered information that veils the singularity. Positive and Negative directions of positive feedback are balanced by the homeostasis of the schemas acting together as a ring. We can think of Positive "positive feedback" as the creation of things and Negative "positive feedback" as the destruction of myriad things of different kinds. Schemas remain constant through all this change and difference. In fact, it is amazing just how stable they are. Repetitions of kinds go through them. They establish the envelopes of spacetime for each thing within which their mass like emergent properties are recognized. Kinds are Set-like which appear as particular representations constrained by essences, but repetitions of kinds are individual instances that are mass-like. Things in general are both set-like and mass-like, these are in fact nihilistic opposites, one being too extreme in difference and the other too extreme in identity. We call the non-

dual between these ipsities in conglomerates. But in general there is good reason for the differentiation between these two approaches to things. It is merely that our tradition has become too extreme in the set-like direction and has seemingly forgotten the mass-like direction of approach to things.

The key point we want to make is that when we look at the relation between schemas and dimensionality we see that they are a set-like way of giving a first categorization of things in relation to the partition of spacetime into envelopes. Different kinds of things in various instances is a second set-like partition of the mass of all things. The word schema has been applied by different people to all three levels, i.e. to the geometry of the thing, to the kind of the thing in general, and to the specifics of the individual thing as an ipsity. We take the word schema only in this first sense here. The second sense is called categories or kinds. The third sense is called the ipsity of an individual unique thing which is a bundle of properties. The kind is found by constraining the bundle of properties with an essence which is a series of rule like constraints on qualities and quantities. It is important to distinguish these various uses of the word "schema" as Umberto Eco does in <u>Kant and the Platypus</u>, but we will only use the word schema to mean the first of these concepts in order to avoid confusion.

So unexpectedly we have answered a central question with regard to the schemas of the geometrical or mathematical, note the Pascal triangle is at the intersection of Boolean logic, Algebra, and Geometry. Why are they dual at any particular dimensional level? Because that allows representational information to be transmitted between schemas without loss. Why does a schema cross dimensional boundaries? Because that allows representations to be propagated up and down the schematic hierarchy also without information loss. A representation is created as we move toward dimension zero from a higher adjacent dimension. A repetition in the Deleuzian sense is created when we move toward dimension N from a lower adjacent dimension. Repetitions move against entropy by unfolding order from a singularity. Information of a lower dimensional schema is repeated thee times and then ordered with the emergent order of the higher level schema. This allows us to move two dimensional levels or one schematic level up toward dimension N. Bekinstein's holographic principle and entropy bound as applied to black holes has allowed us to approach an understanding of this double duality of the schemas, split across dimensions and double in each dimension. Schemas are an efficacious media for the communication downward of representations. But they are also a basis for repetition because the schemas can be built out of just conjunction any two adjacent schematic levels on either side of any given schema. In this case the emergent characteristics of the schema arise out of conjunction of other schemas. The amount of entropy is exactly equal to the amount of information. The amount of information in one schema is exactly a quarter of the information in the next higher level schema. The singularities appear as sources beyond substitution and reversal of the binary bases. At level 64 there are 20 sources beyond substitution and reversal. Substitution and reversal produce all the possibilities at this level which is 2^6. Notice that at the next level down there are ten sources. Four times ten is 40, but the next level has 64 elements. So the number of singularities is doubled, and then reversibility and substitution is performed to get from the

level 32 to the level 64. The entire panoply of possibilities from combinatorics is the arena which unfolds from 20 sources. The origin is the first selected possibility. From that all other possibilities are defined by distance operators. The boundary is the difference between dimensions of different Boolean systems. To move an entire schematic level down toward zero dimension you must move two dimensional levels from 64 possibilities (20 sources) to 32 (10) to 16 (6) which is one quarter of the possibilities. But notice that 4 times the sources at level 16 which are 6 is 24 not 20. So there is a discrepancy between the growth of sources in the central binomial sequence at the core of the triangle of Pascal verses the growth of possibilities in the 2^n sequence. Out of this discrepancy grows the difference between the sources and the arena of possibilities at each stage that determines the emergent properties of the sequence itself.

Expanding the Framework

Once we understand the relation of representation to repetition within the hierarchy of schemas, it is possible to move on to establishing the context within which the schemas are considered. To begin that process we must make a distinction between physus and logos. Physus is growth in things. Logos is unfolding of thought and speech. Both are dynamic and expressions of finitude in the face of infinity. This is a fundamental dichotomy in the Metaphysical era of the Western worldview. Much of our culture and society is built upon this dualistic distinction, such as the more one dimensional and less dynamic distinction between mind and body. In order to understand schemas it is necessary to rehearse this distinction from our tradition. Once that distinction is established then we begin to think about the physus in the logos and the logos in the physus. The physus in the

logos is Logic. Logic is the hard part of language, the part that does not change over time which makes reasoning possible. We can say it is the physus in the logos because language unfolds from our social nature as something pre-given. It does not have just any structure we might imagine but a specific structure of possible logics which we might employ to strengthen our statements. On the other hand language is one means by which we project order onto the physus. We think that the unfolding of the physus is like the unfolding of language, i.e. that it has laws. One of the most fundamental laws is that everything which appears must appear in certain templates of understanding. These are ways of cutting up spacetime into envelopes that are the basis of discerning their kinds. In other words on the basis of these spatio-temporal templates we are able to begin to understand what kinds of things exist as so called natural kinds, and then this is extended to artificial kinds of our manufacture. When we discern their kind then we have assigned an essence to an individual phenomena. The template of understanding comes before the essence but after the establishment of existence. The template of understanding is a primordial projection. In this way it is a projection of logos onto physus before naming can occur. When we stay "this" or "that there" we have schematized. Things appear to us as pre-schematized. We only recognize their schematization after the fact. Schemas are deeply embedded and hidden in experience. We only slowly and after the fact recognize them for what they are which is primordial pre-cutting up of spacetime within experience. Language in general cuts up the Physus by naming. But prior to naming there is a cutting up associated with *this*, *that*, and *the other*, the identification of things as such within spacetime as natural complexes prior to our

knowing their essence or being able to name them. We say that they are an expression of the logos within the physus because language is broken up into letters and words prior to recognizing specific letters and words as such. This primordial breaking up into constitution parts of spacetime is like the initial break up of the fundamental elements of language. This chiasmic cross over between logos and physus generates the black dot within the white and the white dot in the black of the yin/yang Taoist symbol in each case. But for us it distinguishes and separates Logic within the logos from the Schema within the physus at the meta-level.

Between physus and logos there is the non-dual of order. There is order in the unfolding of Physus and Logos. Pure order is seen in Mathesis. The fundamental level of pure order is the category of the set which is used as the basis of logic as well as the basis for grouping kinds of things in the world. What is interesting is that the relation between the mathematical category and logic is seen in model theory. On the other hand the relation between the schema and the mathematical category may be called a representation. The relation between Logic and the Schema is the philosophical category. In our tradition there has been a lot of work done on Logic and Mathesis but little work done on Schematization. So our understanding of the context of the schema is weak. It is almost as if we do not recognize that they are there. Which is strange because they are so oppressively present as everything is precast in one schema or another within experience. This probably comes from the prejudice against the subject and a tendency toward objectivity in our tradition. However just because schemas are projected does not mean that they imprecise as our foregoing argument has shown. So what we want to do here is to explore a more balanced approach to the schema by establishing this framework for understanding the schema in relation to logic and mathematical categories such as the set. Both models and representations come out of the split between mathesis and logic on the one hand and mathesis and schemas on the other hand. A model is defined in Model Theory as a possible interpretation of a mathematical category based on logic. Similarly a representation can be defined in Schemas Theory as a possible interpretation of a mathematical category based on schematization. We have a well developed Model Theory as part of the meta-level of mathematics. But we have no Schemas Theory. In other words if we use mathematics to describe the physus then there must be a schematization. If we use logic to describe mathematics we must have a model. If we use schemas to describe logic or vice versa then we must appeal to Philosophical Categories such as that of Aristotle, Kant or Ingvar Johansson. Categories are the most general concepts and they connect logic to things in experience via schemas. Representations take something more complex and present it again in a less complex form either as an abstraction or by some sort of forgetfulness function. Representations are glosses. We use representations to approximate the essences of kinds of things using categorization. Repetitions on the other hand move from the less complex to the more complex. Repetitions approximate something more complex with various representations that are less complex by multiplying the representations. But as we have noted according to Deleuze this always fails to give an accurate picture of the more complex thing. In a way repetitions are not normally spoken of because they are fruitless compared with

representations which are very successful. In language we use names to distinguish things of different kinds. This very act glosses over myriad differences and clings to the efficacy of reference.

One of the key ideas that we want to get across is that there is something missing everywhere in this cycle from logic, to schema to math back to logic. With respect to representations we have already noted that their opposite repetitions are normally not spoken of at all, because repetitions are messy and fail to bring us back to the more complex phenomena. Too much information is lost in the process of producing the gloss. But there is also something missing in the model. On the syntactic level, consistency completeness and clarity operate, and this is complemented by the semantic level where validity, verifiability and coherence operate. This is interesting because signification appears by the addition of the "aspect of reality" to the mix. In other words, a formal system already encompasses truth; identity as tautology; and presence as the existential instantiation of variables. What is lacking is the distinction of reality. When reality is added,[4] then the semantic level is achieved where signification is produced. So the heart of model theory is the basis for the creation of meta-model theory which can be expanded to describe all the aspects of Being. So in Model Theory the reality aspect of Being is missing which causes three properties of applied formal systems to be obscured and signification to be lost. We call the model theory that considers all the aspects of Being, meta-model theory and we call a logic that considers all the aspects of Being a Vajra

Logic[5]. But this is not all that is missing from consideration. Even our Mathematical Categories are depleted because they only have the set approach to things and not the mass approach to things. Set theory needs to be balanced by Mass theory. Syllogistic Logic related to sets needs to be augmented with Pervasion Logic associated with masses. The addition of the mass category allows us to deal with emergent phenomena that the set logic cannot deal with at all. On the other hand adding the reality aspect of Being allows our formal systems to cease being purely formal and interact with things in the world as well as becoming significant. These additions to the framework provide a very robust way of relating our designs to the world. The problem is that up till now we have not been able to connect our formalisms to reality, we have not been able to describe emergence in our systems, we have not been able to focus on the schemas that relate kinds of things to their spacetime envelopes. This has caused theory and practice to diverge. Once we close these circuits then the framework that appears gives us a very interesting way of looking at Systems Engineering Practice in terms of a more robust Schemas Theory.

Application of the Framework

If we want to apply this framework then we need to discern the nexus to which it is applied. For that, we will use the work of Thomas Etter where he defines Link Theory[6]. Link Theory is a version of probability theory which accepts negative and imaginary probabilities. Link Theory allows us to directly connect classical and quantum mechanical modes of causality. A link is a set of possible

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[4] Nietzsche's goal was to replace Plato's emphasis on Presence, Identity and Truth with Reality.

[5] Vajra Logic and Meta-model Theory for Meta-systems Engineering INCOSE 2002

[6] See papers at http://boundary.org

links between variables. Links are defined by 2^n possible relations between variables plus a count variable. The count variable indicates the existence of cases. As long as the count variable is positive that means there are that many positive instances of the existence of a link possibility. If the count variable is zero then that indicates non-existence. If the count is negative then that indicates a negative probability of existence which could be an impossibility. Such an impossibility may be a weak value taken from a weak measure. Weak measures produce impossible values in the quantum mechanical instance. Weak measures are complex. So though the weak measures it is possible to think about the possibility of there being imaginary counts as well as negative counts. We can even imagine these imaginary counts to occur in hyper-complex weak measures that are quaternions or octonions, etc. In the paper "Reflexive Autopoiesis and Weak Measures[7]" we explore the possible meaning of weak measures on the macro-level. In that paper we stated that all reality is quantum mechanical even the meso and macro levels but that we do not see that because of the projection of Being within the Western Worldview. Underneath that projection, what exists is quantum mechanical in all cases. Link Theory developed by Thomas Etter allows us to see how the classical view is a restricted economy of the wider quantum mechanical view which restricts the count to zero or positive numbers for the link possibilities. Link Theory is a theory of causality. It says that the core of quantum mechanics, the strange part, is actually part of probability theory and not physical. This is a view held by Saul Youssef[8] the physicist who has developed models of

quantum phenomena based on the acceptance of negative and imaginary probabilities. This greatly simplifies quantum mechanics and shows that the wave function is in fact a fiction that is produced by not accepting the possibilities of negative and imaginary probabilities. Thomas Etter is part of the Boundary Institute which thinks it can explain ESP and PSI phenomena using these probabilities. In other words when we raise the veil of the classical Newtonian view of the world then other phenomena that are suppressed by normative science are unveiled. Jahn and Dunne[9] have done replicated experiments that unveil ESP like phenomena with respect to changing probability distributions both at the macro and micro scale. In order to understand how this is possible exotic probabilities that operate at all scales make the phenomena much easier to understand. It also makes quantum mechanics itself easier to understand. It means quantum weirdness operate on all scales. This also means that negative and imaginary probabilities are part of our everyday experience and is something we suppress as we project Being over Existence.

Notice that we are only adding the count variable to the possibilities of links. The possibilities of links is what we get from the dimensionality of the schemas. In other words the Pascal triangle with its progressive bisection is precisely what defines the links. With the count variable we are counting the instances of existence of actualities of each link. So the count variable actually operates at the level of the ontic phenomena. The schema of 2^n possibilities occurs at the dimensional level. Notice that the dimensionality of the schemas is a representation. So link theory

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[7] see http://archonic.net by the author
[8] http://physics.bu.edu/~youssef/

[9] Margins of Reality

connects the existence of ontic phenomena to the dimensional representation. What we bring to this mixture is the projection of the schemas itself. The schemas are static. When we add probability theory that produces a dynamism. Etter talks about Markov chains as a way of talking about dynamics. Dynamics only occurs within the ontic phenomena. It does not occur at the level of the schema. Objects defined by schemas move but schemas themselves are not dynamic as such. So when we create a Link Theory we can use the dimensional unfolding of the progressive bisection to define the possibilities of links. But we add to that the count variable and we recognize that this count variable if it is a restricted economy in the sense of Plotnitsky and Bataille then counts must be positive or zero. But for the general economy counts can be negative, complex or even hyper-complex. Because Pascal's triangle is a mathematical object then we are dealing with a representation when we connect the schema to Pascal's triangle to the instance count variable. Notice that if we are dealing with a model then what we have is statements about mathematical models with truth values associated with them. Those truth values if we use A. Stern's matrix logic can also be positive, negative, fuzzy or even imaginary. When we connect theory the representations to the models then we have a mathematically based theory which is a set of statements about an ontic phenomena delimited by a schema. It is mathematics that allows the connection between the ontic phenomena and the statements of the theory. Representations of schematized objects are connected to truth models of theoretical statements in order to implement scientific method. What is the opposite of this connection is the philosophical categories, i.e. the underlying assumptions that allow scientific theories to exist, such as part/whole,

quality/quantity, causality, and other categorical relations endure. These philosophical categorical systems can take many different forms such as those developed by Kant, Aristotle, or Johansson and others. The direct connection between logic and the schema is through the categories. It is the categories that give the schema its building blocks that make it more than just mathematical relations. Schemas are much more than merely the mathematical dimensional unfolding cited earlier. Schemas are coherences within the set of categories that are logically coherent. That is what makes the schemas emergent templates of understanding. In philosophy, the categories have been well developed but their application to the schemas has been left under-developed. Once we recognize the full structure of the framework within which schemas exist then it is possible begin to develop the aspects of the schemas that embody the philosophical category as the highest concepts.

The Unity of the Framework

This Framework for understanding Schemas Theory is based on the distinction between logos and physus which is in turn based on the deeper distinction between finitude and infinity. These are the major dualisms within the Metaphysical Era of the Western Worldview. Each of these distinctions are associated with a non-dual, in the case of Logos/Physus the non-dual is Order. In the case of Finitude/Infinity the non-dual is rightness. These are just two of a whole series of duals and non-duals that make up the bifurcating tree of the world as it exists today and has for over two thousand years. The world is the arena within which Being is projected by dasein who is known as a being-in-the-world. All such beings-in-the-world

have various modalities of being-in such as present-at-hand, ready-to-hand, in-hand and out-of-hand. These modalities are associated with the various kinds of Being such as Pure Being, Process Being, Hyper Being and Wild Being. Also Being is divided into aspects which include truth, reality, identity and presence. The world is a schema. Dasein projects schemas onto all things in its experience including itself. Dasein's projection is an ecstasy and we posit that it is an overflowing of dimensionalities as Dasein projects higher and higher schematic levels on things, animals, other humans and itself. The fact that Hiedegger talks about being-in-the-world concentrating on the world schema is not essential. We could talk about being-in-a-domain, being-in-a-meta-system, being-in-a-system, being-in-a-form, being-in-a-pattern. We can talk about being-in all the experiential schemas. But we would have to talk of being-out-of-the-pluriverse, or being-out-of-the-kosmos, or being-out-of-the-monad, or being-out-of-the-facet. In other words dasein is only associated with the experienced schemas and is not associated with the imaginary lowest and highest schemas which we do not experience directly as part of our lifeworld, lifedomain, lifemeta-system, lifesystem, lifeform, lifepattern, to use Husserl's terminology instead. The distinction between Physus/ Logos or Finitude/ Infinity are dualistic divisions within the western world schema during our own era. In this way they are articulations of Being at that schematic level. There are various other articulations of the world that are of higher and lower resolution that we will not discuss at this point but they include both lower level and higher level dualites and non-duals.

We can establish that Logos appears as Theory and Physus appears as Experiemental Results on a particular ontic emergent level. As Einstein said the most miraculous thing is that our theory can describe the physical world through the use of math. Our framework establishes this bridge between the two duals via the non-dual mathesis of order. Math is the secret connection between our Theory and our Experimental Results, our torturing of nature. In experiments we make observations of the results of measurement. Measures can be either strong or weak. Weak measures do little or no disturbance of the object of investigation where as strong measures disturb the object of investigation in a way that itself disturbs the result of the measures. Once we understand the difference between the experimental target in nature and the theory that we propound about nature then we can go up a meta-level above each and consider the physus of logos and the logos of physus. The physus of logos is Logic. The logos of physus is the schema. We are well acquainted generally with logic, i.e. the internal laws of thought and language that allows us to keep our statements straight so they don't step all over each other. But we are less familiar generally with the schema which are the internal laws by which we parse experience in order to begin to get at nature. The very first parse we must do is into envelopes of spacetime prior to determining kinds and categories or individual differences and distinctions. With this parsing we can distinguish *this* and *that*. Logic breaks up the logos into pieces which then it relates to each other. Similarly Schemas break up the physus into pieces which then relate to each other in terms of the nesting of schemas. Schemas are like Russian Doll bodies where each doll has a different dimensional shape that fit into each other as a nested hierarchy. The hierarchy is so constructed that there is perfect nesting and no gaps. This is one way we know it is a

projection. It is one of the bases for the establishment of the continuity of experience. It is a first categorization prior to the determining of kinds which separates out various phenomena for further consideration. The number of schemas are extremely limited. But they have an interesting structure which as has been pointed out are determined by the unfolding of the triangle of Pascal with two schemas per dimension, and two dimensions per schema. Once we have understood that logic and the schemas are the result of the co-projection of physus into logos and logos into physus then we can begin to ask about the relation between these two meta-level terms in relation to each other. Schemas relate to Logic via the Philosophical Categories, i.e. the highest level concepts, such as quality/quantity, or causality, or part/whole, etc. Notice that the highest level concepts relate to what has being not just language or logic itself. In other words there must be something to interpret and the highest level concepts link our mechanisms for controlling thought to what has being, i.e. the ontic entities themselves that stand behind the phenonea. Normally philosophy talks about essences. But there is the thisness, or thatness prior to the recognition of the essence or kind. Schemas address this first line of discrimination which separate this and that though templates of understanding for things. We may consider different philosophical category schemes such as those of Arsitotle, Kant, Husserl, or more recently Johansson. Each one has its good and bad points. But what ever set of highest concepts we use there must be a connection established between what appears in the schemas to what we distinguish in propositions that are governed by logic. Schemas are like a cloak that covers an envelope of some portion of spacetime that we isolate due to our

perceptual apparatus or for some other reason. With the schema we say "this item as an envelope of spacetime" in relation to other items that are different envelopes of spacetime. It gives the reference for our statements to isolated entities in spacetime.

When we go beyond what can be said with the highest concepts we would like to say something based on the order of mathematics as well. Mathematics gives us another way of understanding the relations between things other than those proscribed by our highest concepts. However, this is a round about route, rather than a direct one. It means that we first connect the schemas to mathematical categories, like set and mass, through representations and then we connect mathematical categories to logical statements though models. This round about connection between schemas and logic is the basis of science. Science uses mathematics to order the relations between theory and experimental results on ontic phenomena. Implicit in this connection is the necessity of an observation that establishes the experimental results. Now models are normally thought of as being constrained by the logical properties of consistency, completeness, and clarity (wellformedness). However, in our case we will speak of meta-models because we will use the aspect of reality as co-equal with truth, identity, and presence. All of the aspects of Being will be considered. In fact, we will also consider existence, beyond Being, as a sort of aspect. Logic normally considers existence but not reality. Between the four aspects of Being are generated the six properties of a formal system which are consistency, completeness, clarity, consistency, verification, validation. Model theory only really talks about three of these. The other three are necessary for systems

engineering to function properly because they allow us to relate the formal system to the real world. Thus our meta-model helps us broaden our understanding of the relation between mathematical categories and logic. The next step is to broaden our understanding of representation by adding the idea from Deleuze of repetition. Repetition occurs when we travel up the emergent ontological hierarchy, while representation occurs when we travel down it. Our model of Pascal's triangle as constraining the application of schemas is really a representation. It acts representation though repetition of addition as we add adjacent numerical values from the last row of the triangle to create the next row. This repetition of the addition process to produce the next longer and more complex row, produces unexpectedly each geometrically unique dimensional solid within its n-1 dimensional space which is simultaneously the next Boolean basis and an algebraic pattern for polynomials of each possible complexity threshold. So the Pascal Triangle unfolds though repetition of addition and gives at each stage a gateway via the minimal solid for that dimension an emergent dimensional threshold. The Pascal Triangle must be a very special object to so elegantly and simply generate such complexity. As we read downward in the Triangle toward dimension zero we see representations which are simplifications of more complex objects. So for instance the tetrahedrons of three space are representations of slices of the four dimensional pentahedron which preserves some but not all of its structure. In each case a lower dimensional object can give a shadowy representation of a higher dimensional object. Many such lower dimensional representations are needed to approximate the more complex object it is representing. The schemas have this iron clad connection to the Pascal Triangle

as the representation of the relations between the schemas. But as we extend mathematical categories to the level of kinds and unique entities then this connection becomes more and more difficult to discern as the history of Science illustrates. However, it is clear that if we connect ontic phenomena with mathematical categories and then we connect the mathematical categories thorough logic with theoretical statements then we can build a bridge between theory and experience that is very strong and different from the bridge we might build through concepts, however high, alone.

One point we would like to make is that the extension of the mathematical categories from set to mass alone is not enough. As Thomas Etter suggests we would like to rescue other complementary ways of looking at things from physics and make them part of mathematics. So not only would we like to see a mass category but also a field category and a reserve category. Fields and reserves are ideas developed by physics to understand physical phenomena. But they actually belong as categories in mathematics instead. Each has its own associated logic as well. So Fields have a transformational logic of intensities, and Reserves have a conservation accounting logic of potentialities. Each of these different categories are associated with a kind of Being. So Pure Being has sets as its object, while Process Being has masses as its object. But also Wild Being has fields as its objects and Hyper Being has reserves as its object. Thus the base categories of mathematics is ordered by the kinds of Being. Not all is determinate like particulars of sets. Some are probabilistic like instances of masses, possibility like potentials of reserves, and propensities like intensities of fields. According to Wolfgang-Rainer Mann in The

Discovery of Things[10] Arsitotle set us on this path of looking at things from an almost exclusively set-like basis. Plato, Socrates and pre-Socratics all were oriented to things in a mass-like way similar to that we see in India and China. In the process of developing Physics we discovered the Field and Reserve approaches to things. They do not deserve to be part of physics even though they were discovered by physics because they are actually mathematical ways of understanding many different kinds of things. Both transformations and accounting are mathematical. All functions are transformations in mathematics. Mathematics was first developed for accounting purposes in the early civilizations. In fact, accounting is said to preceded writing. These are basic categories of mathematics, although they have not as yet been recognized as part of math, just as quantum mechanics has not yet been recognized as part of probability theory. The question that the mathematicians do not answer is why are the mathematical categories as an overall structure so strange and incongruent as a set of possible mathematical objects. One reason may be that three quarters of the categories are actually missing because three of the four fundamental base categories are missing. If we plug in these three new base categories then the structure not only begins to look more elegant but also is more useful because it is these other categories and their offspring that we need in order to make use of mathematics. They were invented in physics but their usefulness is more general than physics. In point of fact we need them in Systems Engineering if we are to be successful. Once we recognize that mathematics is not just determinate but that we need to apply the kinds of Being to

Mathematical categories then it becomes clear that probability theory appears on the basis of Process Being, and it is at this level that Etter's Link Theory can be recognized as the basis or understanding causality in both the classical and quantum mechanical ways. Link theory adds the count variable to the 2^n possibilities seen in Pascal's triangle. Link theory postulates the usefulness of negative and imaginary, not to mention hyper-imaginary numbers. Once we admit Link Theory as a combination between possibility and probability then we automatically are open to very complex and sophisticated interfaces between logos and physus. A variable in the logos, say as a measurement device output, and a variable in the physus, say as a measured system, can be linked by not just probablisitc counts, but also exotic probabilities that are negative and imaginary. We can interpret the negative probabilities as impossible. But this impossibility splits, because negative one is a singularity and that opens up the various levels of hyper-complex imaginaries which are the inner horizons of that singularity. The splitting of impossibility into imaginaries, as subtle violations of impossibility, is something that effects us on the macro level as well as the micro level. In systems practice we call that murphies law. Close to impossible things actually have highly imaginary probabilities. Outwardly the singularity signifies impossibility, but inwardly there are all these imaginary probabilities to contend with, which is in fact the source of emergence. The rewriting of history and the future in the emergent event is the sign of the unfolding of the singularity so that we see it's inside appear outside because the singularity itself envelops us. What is impossible prior to an emergent event becomes possible afterwards and vice versa with respect to before.

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[10] Princeton UP 2000 ISBN: 0-691-01020-X

The framework makes small but significant addendums to the standard theory of how science operates in each of its areas. For instance, we recognize not just standard logics but also the para-consistent and para-complete logics such as Dimond Logic of Hellerstein and the Matrix Logic of Stern. With respect to the relation between infinity and finitude this gap is closed by the work of Dr. Stefan Hilger[11] on Measure Chains or Time Scale Calculus. Measure Chains reconciles the differences between difference and differential equations. What had long seemed an irreconcilable difference now seems to be part of a greater overarching structure like the difference between Euclidian and non-Euclidian geometry. However, the extensions to the standard elements of the framework help make our systems engineering reasoning easier. The key problem has been that we had only part of the conceptual tools we needed in place to deal with complex systems which we were building regardless of being ill equipt. The framework gives a foundational language for talking about the place of the schemas in the order of things. It gives us a way of relating to the ever more complex systems we are building, in many ways by moving things that appeared to be part of physics proper out to a level where they are more generally useful. The problem is getting a picture of how these various pieces of the extended standard model fit together and are used together to describe situations of practical import. At this point we are still merely setting out the groundwork that will allow us to pursue the grounding questions as to the nature of the schema in the philosophical and scientific tradition of the West. We still do not understand how it

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[11] http://mathsrv.ku-eichstaett.de/MGF/homes/didphy/index.htm

relates to the theory of Forms of Plato, or the Categories of Aristotle, or the Schemas of Kant, or beyond that to the Phenomenology of Husserl and the work of Heidegger and beyond into continental philosophy. Analytical Philosophy pretends that it has a lock on Philosophy of Science and that Continental Philosophy is irrelevant to science. But in fact, it is Continental Philosophy that can give us the deepest insights into the workings of science because it has explored the limits of the world in a way that Analytical Philosophy has failed to do. Analytical Philosophy is stuck in a narrow circle going round and round the ragged rock. Continental Philosophy on the other hand has picked up the rock and looked underneath it at the fragmentation of Being itself. It is this phenomena that underlies at the deepest level the framework which we have attempted to describe here in this paper. The framework is a very advanced way of approaching things which takes into account the latest advances in several fields and tries to incorporate them into our knowledge of how things work so that we can build better complex systems and think about them in ways that are clearer and have impact practically. Over the course of these essays an attempt will be made to show how the various aspects of this framework interlock and are mutually elucidating as well as how they help us understand the phenomena that we deal with as systems engineers on a daily basis. However, this attempt to elucidate the practical aspects of this new framework will follow on an attempt to root it in the Western Tradition so it is clear that we are only departing slightly from the roots of our philosophical, scientific and technical tradition. We are engaged in understanding it differently, based on results in different fields that we will leverage off of in order to attempt to build a

new basis for Schemas Engineering out of the
bedrock of General Schemas Theory.