

ADVANCED SYSTEMS THEORY FOR SYSTEMS ENGINEERS

Introduction to the Anti-thesis

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Summary:

None yet.

What needs to be said first

Systems Engineers need to understand Systems Theory. This book shall serve as an introduction to advanced systems theory for the practicing Systems Engineer. Now by Systems Engineer is meant anyone who does systems design, or takes systems requirements, or builds systems, or tests systems, or operates systems. Anyone who has a hands on relation to systems of any

kind. We do not just mean practicing Systems Engineers, but this can include Software Engineers, Industrial Engineers, Manufacturing Engineers, and those who just think of them selves as Architects and Designers from any profession. Systems are ubiquitous, but little understood, except in terms of generalities which lead to the word system being as common as the term object, or entity, except we mean a set of objects, or a set of entities and their relations. The word "system" is so broadly used we do not understand what it means any more. This book is meant to address that concern. This book will tell you what a system is in relation to other schemas, and what the other schemas are. It is meant to expand your horizon from just thinking about systems to other types of templates for looking at things that are different from systems. Eventually we will talk very broadly about Schemas Theory for Schema Engineering and we will see that the discipline of Systems Engineering is a very broad discipline and the tool box of templates of understanding and designing things can be much expanded from reliance on a single schema, such as the system. But all of these riches in terms of schemas eventually leads back to give a context to systems theory as it relates to systems practice. In other words we will go on an adventure of systems thinking that will range widely beyond the confines of merely systems thought into other forms of thought that the systems designer and engineer should be aware of as a context for dealing with systems. In this way it is hoped that the reader's horizons will be expanded. And in the process the foundations will be laid for even more advanced theory and practice with deep implications for the transformation of the discipline of systems engineering. But it is important to start where we are with the system, understand how we got here to the place where we recognize systems theory as a discipline and its relation with systems engineering. Then we can begin to expand those horizons beyond systems theory and systems engineering toward other templates

of understanding and other ways of looking at things which give a broader context to systems thought. Systems thought is a broad stream of understanding which has taken centuries to develop, it is a fundamental paradigm which has overcome the mechanistic paradigm that preceded it. It will take some doing to go beyond this paradigm to an even more adventurous paradigm in the future, but in this book we will attempt to lay the ground work for that change. This is a bridge to the future. The bridge must be built from both directions. This book will build from the current paradigm toward the other shore of the future paradigm. Its companion book will build from the future shore toward this current paradigm. Between the two books it may be possible to leap from one paradigm to the next and thus advance our discipline one more step in the unfolding evolution of our understanding of things. That other book will be called *The Foundations of Emergent Meta-systems Theory and Practice*. It is the book of the future of the discipline. But here we need to say many background things that cannot be said in that book. It is like the move from Newton's Theory of Mechanics to Einstein's Theory of Relativity. Or it is like the move to Quantum Mechanics. It is difficult to justify in the old paradigm. Differences between paradigms at most turn on decisions of aesthetic choice. We must weight for the current generation tied to the current paradigm to die out, before change is really possible. It is only those seeking an alternative to the "standard model" what ever it is that ventures to take up the lens of the new paradigm and try it on. However, we must make it possible for those in the old paradigm to be adventurous if they so choose. So although, it is easier to teach the new paradigm in its own terms rather than as a translation out of the old paradigm, it is necessary to define the jump off point very carefully in terms of the old paradigm. This jump off point for the leap to the new paradigm will be presented here. This is a passenger vehicle into hyperspace that you

can get on or not as you choose. When you deal in the terms of the new paradigm there is no time to get used to the idea of jumping because you are already there, working in the context of the new paradigm. There is no time to consider the problems that the old paradigm was solving that are now irrelevant. There is no time to consider how the future possibilities and history have changed due to the paradigm shift, because we can no longer see things from the view of the old paradigm. Before the old paradigm of systems theory and systems engineering vanish into the pages of history, we need to capture them, as a jumping off point for the transformations that our understanding will undergo as a result of this involuntary paradigm shift. One reason is that they themselves have not been around all that often before being declared history. There is a certain nostalgia when we hear people talking about systems, who do not yet know that they are in some sense passé. When we want to go back and relive those days in the future then we need some record to turn to which tells us what the anomalies were that forced a reevaluation of the whole field of systems theory and its associated practices. How was it that systems theory became aware of systems philosophy and process philosophy and became reflexive before it exploded into what we might call tentatively schemas theory with its associated practices. How was it that new horizons opened up that made it clear that systems theory was inadequate to deal with the problems we faced as engineers, as architects, as designers. Once everything has changed with the leap across the abyss to the paradigm of Schemas Theory, then all this will become quaint history. But it is important to capture this moment, the moment of transformation of systems theory into something else, something unheard of previously, something emergent, something beyond the system, something like the emergent meta-system which is the core of the new paradigm of which we speak. This is going to be a wild ride, no holds barred presentation where the

key word in the title is “Advanced”. We are going to advance to the very frontiers of systems theory and practice and look beyond those frontiers at what is utterly new. We are going to do this in a step by step fashion. But each step will be some increment of the jump to the other side of the abyss that separates us from the new paradigm. However, in this book we will never arrive at the other side, because to do so is to be completely immersed in the other paradigm. That is the task of the alter ego of this anti-thesis. But the two books will play off of each other and evolve with each other as we attempt to transform ourselves from naïve followers of the “standard model” of systems theory and practice. In this there is some self-overcoming of the style that Nietzsche talks of in Zarathustra. In this self-overcoming both the author and the imaginary reader will be involved and implicated. This is not the sort of book you can just set back and passively take in. This book is intended to challenge your very idea of a system, and what it means to be a system designer, system architect, and systems engineer. So beware, entering this thought space, is like you stepped into the adventure movie rather than merely being a passive audience. I hope to challenge you as I challenge myself, because I myself need to make this leap, and in the end we will be leaping together into unknown space between the two (once and future) paradigms. When I put out my hand to hold as we jump together remember that I am new to this strange and wonderful new territory myself and I don’t make any guarantees as to what is to be found on the other side. It is a mostly unknown territory for me as well. However, here I am going to try to convince you that jumping there is the only choice that we really have. The good thing about it is that it is really only a theoretical jump at the moment, and what I am trying to do is to get you to suspend disbelief and try it out to see what happens. I believe that it will transform the practice of Systems Engineering eventually, but for now how it will transform that practice is more or

less up in the air. Right now because this new paradigm is so tentative, there is no real investment to go over and stake out some real estate. Later the investment will be greater if you decide to live on this new continent of thought and ways of acting that unfurl from the shift in ways of looking at things entailed by this change. So take a chance, and see what happens. What more can you loose but your entire way of perceiving and acting toward everything.

First Approach: Phenomenology of Systems

Our first approach to this new venture will be through phenomenology. So right there you know that something is different. Phenomenology is the scientific description of experience itself. It is the study of the phenomenon as it presents itself, in its own terms, not merely as we project it to be. Phenomenology was inaugurated by Husserl. We won’t go into a big explanation of Phenomenology because there are already many good books about it. All we want to do is focus ourselves as systems theorists and practitioners on our own experience in the process of systems selection, architecting, systems design, systems implementation, systems testing, verification and validation, etc. All our experience can be approached phenomenologically, and we can think as observers about that experience. Part of that experience are the systems concepts we use and how they are used in the process of working with systems. The question immediately becomes what are the grounds for the efficacy of those concepts. And just by asking that question we enter a very sticky ground where we struggle with the definition of a system, we struggle with how to describe the system, how to build the system, how to integrate the system into an environment with other systems. Phenomenology directs us to look at the system concept in the context of our systematic practices very carefully. Then

it directs us to use those experiences as the basis of our understanding, not just ideas about what a system might be, not preexisting habitual systematic practices just because they already are part of our technical tradition. Phenomenology focuses us on the key problem right away, what is the nature of a system, and how is it useful in practice. Why is it ubiquitous in our scientific and technical culture. Is that ubiquity really hiding assumptions that we should be questioning? And when we question those assumptions what will happen, well, of course, a paradigm shift might happen. The concept of the system we feel so comfortable with might get away from us, we might realize that we never really had a grasp of it. That is the danger of treating the concept of a system phenomenologically, we might see the system itself for what it is, and by that be transformed ourselves, so we see things differently.

I would like to offer a suggestion for a preliminary definition of a system. There are many definitions to choose from and almost all of them say that a system is a *set* of things and their relations. In other words, a system is reduced to the mathematical category set, and the functions of that set many of which establish relations between the members of a set. A set is the simplest well accepted mathematical category. However, usually a caveat is added that a system is a whole greater than the sum of its parts, i.e. it has some emergent properties at the level of the set itself. Rescher in his book Cognitive Systematization says that our root metaphor of a system is the organism. He lists a series of properties that are normally assumed of a system. What is interesting about these properties is their seeming internal incoherence. So on the one hand we have a more or less minimal category of set with its functions that relate its elements and preserve structure on the one hand and on the other hand there are the properties that we associate with the emergent properties of a system that approach a definition of

wholeness whose metaphor is the organism. Between these extremes there are many definitions perhaps the most interesting of which is that of Bunge. But here we will not be arguing about the details of the definition of a system, as if it were an ontological entity in the world. Rather we will propose a definition which turns upon the idea that a system is a projection and is not something in the world. Rather, we shall see it as the conceptual equivalent of a social gestalt. In other words a system like a gestalt is a perceptual configuration of figures on ground. It is socially projected and the individual projection of a system is a degenerate mode of presentation. This means it is a socially invented and constructed reality, identity, truth and presence. We take advantage of the sociological paradigm of the social construction of reality developed by Berger and Luckmann as a basis for understanding how systems are projected outwardly and reified and then impinge back on the social groups and individuals within those groups that project systems as a template of understanding of things. We say that just as we see gestalts when ever we look around us, we grasp systems as conceptual equivalents of gestalts as a noetic moment that is associated with the noema of the perceptual gestalt. This vocabulary of noesis and noema was developed by Husserl and extended by Gurwitsch to include gestalts in The Field of Consciousness. It is a short step from Gurwitsch to a 'phenomenology of Systems' for systems are merely the noetic counterpart of the noema of gestalts when considered in an intersubjective phenomenology such as that developed by Finch in the Sixth Cartesian Meditation. All other definitions of the system must relate to the phenomenology of the systems concept as used. Here we are talking about the systems concept as given in intersubjectively mediated consciousness as a template for understanding of things. We look at the phenomenology of the system concept (as noesis) as the counterpart to the phenomenology of the gestalt in perception

(as noema). We see it as a projected template of understanding, not as something that exists in the world of things, per se. The fact that systems are projected templates of understanding, or schemas, is why their definition is so difficult to sort out. As long as we consider them as things out in the world then there will be disagreement about the nature of the system, because the things that they are projected on have different properties, and thus lead to different syntheses. But if we remember that a system is in the eye of the beholder, almost literally as the coherence of a set of gestalts by which we see various things as the same or the same thing from various viewpoints, then we will be able to understand what a system is in a much clearer fashion.

We will go ahead and define the idea of the system as the unity of presences, the essence of a system as a unity of absences, the noematic nucleus of a system as a totality of presences, and the arche or source of a system as the totality of absences. The things that a system is made up of, i.e. the forms, are a plurality. From the plurality we can move in two directions, toward unity or totality. If we move toward the unity of presence then we have the idea of the system. If we move towards the unity of absences then we have the essence of the system, which we also call the concept. Absences in this sense are constraints on the attributes of the system. If we move toward the totality of presence we have the noematic nucleus, i.e. how the system looks from all views. If we move toward the totality of absence then we have the arche or source of the system, i.e. its archetype, or template, or schema. In this way we can understand how a system as concept and gestalt perception fits into the Platonic metaphysics we have inherited in our tradition which is a metaphysics of presence, or as Derrida says a logocentrism.

Taking the phenomenological perspective is an invitation for the reader to look into their

own experience with the concept of the system and see how it appears in your own consciousness and discursive practices. When you look at it clearly I believe you will see that what ever you designate as a system or is designated by others becomes a system, the boundary could be anywhere that it is defined to be, and this is what makes the system such a problem, because consensus is necessary to fix the boundary of the system, they do not come prepackaged as they should if they were actually part of the physical environment and not projections of our understanding. Now this is good because it makes us aware of our own projections. It takes us away from the naive response of thinking our projections are actually part of the environment, which is called magic. It is strange to think that so many definitions of systems are actually in some sense superstitious or magical, but that is what they amount to if we think systems are out there in the world and not merely socially constructed realities. It is the fallacy of misplaced concreteness to think that systems are real things out in the world except as far as we agree upon them and project them together as socially constructed phenomena. Of course when we project them intersubjectively and reify them then they act back on us as if they were objectively there. This is the dialectic that social construction of reality produces, we forget we defined the boundaries of these systems ourselves, yet they seem to act as if those were real boundaries once they are reified and objectified. This is of course what is called alienation, when the products of our own praxis act back on us in ways that are coercive because they are socially agreed upon and become designated realities.

Gestalt and Flow: System and Process

Now that we have entered into the phenomenological spirit and decided to look at our own experience with the concept of system and its relation to gestalts in our

perception, we can extend this adventurous way of looking at things, by realizing that the dual of a system is a process and the dual of a gestalt is a flow. Rescher has challenged us to connect process philosophy and systems theory. So let us begin to do so by thinking about this duality, which I think has been right before our eyes for a long time without being explicitly recognized in the literature. When we think about a perceptual gestalt we see it as a figure on a background. There is a dynamic tension between the figure and the ground in the gestalt, and when we change to another figure we see a different dynamic tension snap into place in our perception. But a flow is where the vague background becomes a foreground flow and the figure is pushed to the back and becomes a reference point for the flow. So the configuration of a flow with reference point is exactly opposite that of the gestalt. When we recognize this duality we then immediately see that there is no gestalt without an associated flow and vice versa. Our perception is set up such that flows and gestalts are complementarities and that they are continually changing places as to which is emphasized and which is de-emphasized in our experience. That is the situation with the nomema so a similar situation appertains with the noesis. That is to say the concept of the system, and the concept of a process are similar duals which are complementary. Where ever you have a system there is an associated process and vice versa. We are starting to realize this when we use the CMMI as a standard for assessing our work processes that are used to build the systems that we produce. The work processes have been invisible up to this time, because all we cared about was the product system. But now these background work processes are becoming visible and we are realizing how difficult they are to change. But this duality between the system concept and the process concept is merely the noetic counterpart of the noematic duality between gestalt and flow. This is a set of complementary complementarities. And if we look for them phenomenologically then we

suddenly see how they are everywhere we look. Associated with noematic gestalts and flows are noetic systems and processes. Like the system the processes have an idea, essence, noematic nucleus and source. The idea is always the unity of presences, while the essence is the unity of absences as constraints on attributes. We could use Heidegger's terminology in *Being and Time* and say that the unity of presences is present-at-hand and the unity of absences are ready-to-hand. One is an abstract gloss while the other is related to the phenomena itself as the set of constraints around its attributes. But what we don't normally see taken into account is the totality of presences which is the noematic nucleus as seen from all views, and the totality of absences which is the arche of the thing, which Plato spoke of as the source. Philosophy normally concentrates on unities and forgets totalities. However, plurality and unity and totality are the three dialectically related categories in Kant's category system in the Critique of Pure Reason. We would like to extend this to consider the whole which is the non-dual between the unity and totality which Kant did not consider. If we add this forth moment to the dialectic then we would find ourselves considering systems as not just unities and totalities but as wholes, and we would do the same thing with processes.

So now we are beginning to produce a rich set of phenomenological concepts and percepts which are a complementarity of complementarities. And we can begin to look for these complementarities in our own experience. We can look for the corresponding process for all our systems and the corresponding systems for all our processes. We can look for the corresponding flows for all our gestalts and the corresponding gestalts for all our flows. We can then see how gestalts cohere around systems and flows cohere around processes. We can consider the ideas of systems and the ideas of processes that we project as present-at-hand. But we can also consider the

essences of these systems or processes which we call conceptual. We differentiate the abstract gloss that is an illusory continuity from the actual constraints on the attributes of the system or process under consideration. But we also look at the inverse in which we consider the associated totalities by looking at either presences or absences. In the case of presences we have the noematic nuclei of the system or process or the arche of the system or process in the case of the totality of absences. This arche is what we refer to as the schema, it is the source of the projection of the template of understanding of either system or process. It is what gives coherence to all possible uses of these templates of understanding. It is what makes all systems the same despite all the different kinds of things they are projected upon. Not recognizing the schema is a major draw back to most theories of the system or theories of processes. It is the schema that connects the system, process, gestalt and flow together so they belong together as the same. And as we will see systems and processes are not the only schemas. But at the moment we are stuck trying to understand these as a basis for understanding schemas in general. And what we want to understand about them is that they form a fourfold complementarity of complementaries. And what we would like the reader to recognize is that this fourfold permeates our experience so that we use gestalts to see systems, systems to see processes, processes to see flows and flows to see gestalts. In other words, they are mutually elucidating and permeate our experience in every way imaginable. As practitioners we are called upon to see systems, processes via various gestalts and flows constantly, and not just see them but design new ones, to fit in with hoards of other ones. We live and breath systems and processes as conceptualizations seen through a myriad of gestalts and flows that cohere about them in our experience. We create abstract glosses of them which we project on our experience, but we also draw upon their essences as the basis for grounding those

abstractions. Thus there is a play of presence and absence around unity. But there is also a play of presence and absence around totality which we see in the noetic nuclei of these concepts that corresponds to the noematic nuclei of the percepts. The noetic nuclei is the set of possible conceptual views of a system or process. The noematic nuclei is the set of possible perceptual views of a system or process. There is also the totality of absences that is the arche, or source, or schema of the system or process. Finally we have the play of presence and absence around wholeness. Systems are seen as wholes with emergent properties rather than just sets with relations. But the wholeness is the non-dual of unity and totality. It is neither unity nor totality while being both. It is not unity nor is it totality nor is it plurality, but something different, something more, which is yet hard to define but which we recognize when we see an organism which is our metaphor for an whole. In other words, it is an anthropocentric, or at least biota-centric, concept because we ourselves are organisms. In other words, when it comes to wholeness we are some sense looking to define other things in terms of ourselves which is a form of paradox. But it is perhaps a novel idea that we can have both wholeness of absence, i.e. holes, and wholeness of presence. Systems and processes can be things like vortexes, hurricanes, tornados, etc that are wholenesses of absence rather than wholenesses of presence. Blackholes might be an example of a system that is a wholeness of absences. In any case it is good to keep in mind these distinctions which flow from a fourfold dialectical vision of the relations between absence and presence, or showing and hiding, in which the extended dialectical Kantian Categories are interacting what a particular aspect of Being as a framework for understanding the phenomenology of the noetic (conceptual) system and process as well as the noematic (perceptual) gestalt and flow.

It should be noted that we can substitute any

of the other aspects of Being, i.e. truth, reality and identity for presence in the above formulation. All of the aspects of Being are foundational to the system and process schema. It should also be noted that where system as a gestalt participates in Pure Being and the associated processes participate in Process Being, we can also think of these in terms of Hyper and Wild Being. In terms of Hyper Being we would note that some aspects of the system fall under the Godellian prohibition of closure, so that some statements concerning systems or processes are undecidable, and thus participate in Difference as defined by Derrida. Similarly in terms of Wild Being we can see that a fusion of System-processes or Process-systems are chiasmic like relativistic Spacetime or Timespace. The interaction of systems and processes are non-intuitive and complex rather than simple and straight forward. It is this complexity that we wish to begin to study here. The naïve view is that we can easily determinately separate systems from processes and that they form a monolith which can be dealt with routine practices. However, in fact the practices end up being non-routine and complex because of the fact that beyond the present-at-hand system and the ready-to hand-process there are in-hand elements which cannot be determinately assigned either to system or process and remain Godellian. And beyond that there are out-of-hand chiasmic aspects of the system-process or process-system that are intaglio. Meaning that they form reversible phase spaces within the interval of the process-system or system-process. This leads us from Godellian hyper-process or hyper-system undecidable moments of the system or process right into complex systems theory and chaos dynamics. It is only by walking up this staircase of the Kinds of Being and by relating the system and process motifs to the Aspects of Being and the Categories that we begin to see this hidden complexity beyond our attempts to render everything determinate and objective.

Kinds and Aspects of Being

This analysis of system-processes depends on an ontological analysis of the Kinds and Aspects of Being which needs to be understood as a background to our work at the system theoretic or process theoretic level. Up until Husserl and Heidegger there was really only one kind of Being considered in philosophical ontology, which is called Pure Being. This is the Being proposed by Parmenides and turned by Plato into the basis of his philosophy of presence or logocentrism. This is the kind of Being championed by Descartes as the 'sum' in the famous dictate 'cogito ergo sum'. It is the kind of Being that Kant discusses in the Critique of Pure Reason. The only dissenting voice was that of Hegel who listened to Heraclitus and realized that process had a place in ontology as well, which he expressed as the Dialectic. Process Being which is the opposite of Pure Being was championed by Heraclitus, the Sceptics, and Hegel, as a minority opinion in the history of Philosophy. However, Husserl working within the transcendental framework set up by Kant found a necessity for incorporating the process centered view into the framework of traditional ontology. This occurred because he realized that there was a difference between essences and ideas and that essences were not just simple ideas. This became obvious though his phenomenological studies of the nature of essences that were the determiners of the nature of things that were clearly different from our abstractions cast over the things as glosses. Once this difference was established within the transcendental framework by Husserl as the difference between eidetic intuition, or essence perception and ideation, then Heidegger could establish this same difference on the ontological level as a difference of kind within Being. This was done in Heidegger's Being and Time as the difference between present-at-hand modality and the ready-to-hand modality of apprehending the world by dasein. Merleau-

Ponty went on to distinguish these modalities in psychological terms as pointing and grasping in The Phenomenology of Perception. Dasein was the nature of the projection of Being shared by Subject and Object, i.e. it is what is prior to the arising of the Subject/Object distinction which is the source of the ecstasy of projection of Being in the world. It was only by focusing on the schema of the world that Heidegger could differentiate these modalities of Dasein. We could construct a similar argument focusing on any schema, the system/process for instance if it were necessary. The best presentation of this is by Pauli Pylkko in his book The Aconceptual Mind. So I won't belabor the point here but assume that it is understood that prior to the arising of the subject/object distinction there is the being-in-the-world of dasein (t/here being). We could just as well say being-in-the-system, or being-in-the-process, or being-in-the-schema for our purposes. Dasein is the ecstatic projection of the system schema, or the process schema, prior to the distinction arising of subject or object, observer or observed. For the distinction between subject and object to be founded there must be some level on which they belong together and are the same, that is why Nietzsche said that subjects are merely objects turned inside out. If we are concerned with projection of the schema per se then we want to focus on the level of dasein rather than at the level of reification of subject and object as a designated as real, or true, or identical, or present distinction. Dasein projects a monolith that has two modalities, one present-at-hand sees noematic gestalten and noetic systems, the other that is ready-to-hand sees noematic flows and noetic processes. By these two modalities dasein as being-in-the-system or being-in-the-process is founded and relates to the system or process as such which eventually differentiate out as the observed process and the observer, or the observed system and the observer. The difference between these two modalities is the nature of Hyper Being, and

the chiasm in their interval is the nature of Wild Being. It is these further modalities of Being that we will now introduce.

Once Being which was thought to be a pure plenum, both the most universal concept and the most empty, was found to have a differentiation of modalities within it, this opened Pandora's box and the gold rush was on to identify further differentiations of Being. Heidegger and Merleau-Ponty went on to identify the next type of Being, which is called here Hyper Being. Heidegger called it ~~Being~~ (crossed out). Merleau-Ponty in The Visible and the Invisible called it the Hyper Dialectic between Being and Nothingness. Derrida went on to describe this third kind of Being as Differance (differing and deferring) which he made famous under the auspices of Heidegger's term *deconstruction*. Then Merleau-Ponty went on beyond that to define Wild Being, as the chiasm of reversibility in the interval between Pure and Process Being rather than their undecidable difference. Hyper Being is what is different between the two modes of the monolith of Being while Wild Being is what is the same. These are two sides of the same coin and stand as the complementary opposite of Pure and Process Being. In Wild Being the intaglio of propensity is inscribed beyond the traces of Hyper Being. Other philosophers have gone on to explore this strange territory attempting to build Philosophies at on the frontiers of Wild Being, like Deleuze and Guattari, John S. Hans, Cornelius Castoradis. Wild Being beyond Hyper Being is the frontier of philosophy today and the two together define the Postmodern in all its glory. The author in his 1982 thesis at the London School of Economics called The Structure of Theoretical Systems in Relation to Emergence found a framework for understanding the relation between these various kinds of Being based on Russell's Theory of Higher Logical Types as explained by Copi. In that theory paradox, such as the paradox of Being, is untangled by separating levels of logical typing by employing the rule

that no set can be a member of itself, i.e. by demanding that sets are well-founded. Thought of this way the kinds of Being are really levels of Logical Typing. First we establish as Heidegger does the distinction between Being and beings, i.e. ontological difference. Then we recognize that Being has logical levels, i.e. meta-languages within it. The first meta-level is Pure Being which is static Parmedian Being. The second meta-level is Process Being which is dynamic Heraclitian Being. The third meta-level is that of Hyper Being, which is the non-decidable difference between the two phases of the monolithic interval of Being, i.e. between noun and verb, Being and Becoming. The fourth meta-level is the chiasm of reversibility between the two phases of the interval which Merleau-Ponty calls *Flesh*. What is odd about this ladder is that it leads nowhere. In other words the hypothesis of the author is that there are only four kinds of Being and no more, and that the fifth meta-level of Being is strictly *unthinkable*. As such it refers to *existence* and can be interpreted in a Taoist fashion as *void* or in a Buddhist fashion as *emptiness*. However, this is a hypothesis and it is still an open question whether the next level of Being, i.e. Ultra Being can be thought. What cannot be thought is not Being, since as Parmenides said 'Being and thinking are the same'. The end of Being is the interface with existence. This interface will become very important for use as the argument unfolds.

In keeping with Russell's theory of logical types there is a demand not just for levels of languages but also a ramification of types at each level. These types are here seen as the aspects of Being that include Truth, Reality, Identity and Presence. Aspects of Being are orthogonal to the Kinds of Being. Each forms a minimal system of differentiations that together give us the qualitative differences demanded by the theory of logical types. The aspects are the way that the verb Being in general is used in Indo-European languages.

Truth = A is B.
Reality = A is.
Identity = A is A.
Presence = This is A.

These Aspects of Being are just as significant as the Kinds of Being. We already saw them appear in relation to the categories, in terms of the unity and totality of presences. But as we saw we can take any of the aspects and apply them to these categories. The categories are since Aristotle the most basic kinds of statements we can make about things. They are the next rung down from the concept of Being itself. They are the primordial differentiation of concepts from the most general concept of Being. Aristotle, Kant, Hegel and Ivar Johansson have advanced categorical theories of interest, but for the most part categories are ignored by meta-physical philosophy. They are however important for us as we are interested in the relation between philosophical categories and the schemas, such as the system or process. In general, the kinds and aspects form a sixteen fold differentiation of Being into facets and these facets are related to the philosophical categories which is the next level down of differentiation of Being in terms of propositions rather than just nouns and verbs alone. It is at the categorical level that wholes and parts are seen or causality expressed among other fundamental concepts that are the basis of rationality. Kinds and Aspects appear as a way of disentangling the paradox, or vicious circles, or absurdity, or even madness of Being which is unique to the Indo-European linguistic and philosophical tradition. When Being differentiates into the fundamental concepts that can be stated as propositions then we have the possibility of understanding at its most fundamental level in which Being is differentiated not just as

Kinds and Aspects but conceptually as well. This conceptual differentiation is then applied to the schemas which are projected on the things as templates of understanding. Part of what we will be trying to do in what follows is to understand schematization and it's relation to the philosophical categories and the kinds and aspects of Being. If the philosophical categories tend to be ignored then schemas are not treated at all. Schemas are preexisting ontological templates of understanding that are projected on ontic phenomena. Heidegger focused on the template of the World in his work, but there are other templates like systems that are equally viable. Part of what we wish to do in this book is explore the relations between these other schemas. Notice the modalities or kinds of Being only became apparent when connecting to the schema of the world. Schemas are related to the Kinds of Being and Philosophical Categories are related to the Aspects of Being. That is why we connected the categories of part and whole from Kant with the aspects of presence/absence. But this is not the whole picture. The complete picture takes into account not just the relation between kinds and aspects but also between categories and schemas. This is because the categories are the most basic kinds of statements that can be made about things, and the schemas are the most basic templates for the things being talked about. Traditionally the fundamental template of understanding has been the 'form.' Only recently have other templates been developed that include 'pattern' and 'system'. But in the literature these templates are normally immersed in subject specific discourse and are difficult to draw out and describe in a generic way as we have the 'system' template since Karl Ludwig von Bertalanffy book on General Systems Theory. 'Form' has been well described as a template for understanding, 'pattern' is much less well described than the template of the system. Other schemas are even less known than the pattern schema. If we are to develop a general schemas theory then we will have

to search the literature for these templates of understanding and by comparison and contrast distill out the key elements of each one so that we can understand them in all their various contexts as we are beginning to do with system after the fashion of our thorough understanding of forms and our less well understood template of patterns. Here we will advance a hypothesis as to a hierarchy of schemas tentatively. But it is incumbent on our philosophy of science to isolate the key templates in our tradition and to study them as we have the history of ideas. There is not yet a history of schemas, i.e. the sources or arche that underlie the metaphysics of presence that are the inverse dual of the ideas.

Formal Structural Systems

The individual schemas need to be studied for sure, but the way that we encounter them most usually are in combinations which attempt to maximize the reach of understanding. The best example of this sort of conjunction of schemas in a single systems theory is the conglomerate of the formal structural (patterned) system. A good example of this sort of theoretical conglomerate is the work of George Klir in Architecture of Systems Problem Solving. In that work Klir produces a general model of a formal structural system, which are normally totally embedded in particular disciplines or universes of discourse revolving around specific topics. For instance, Jacque Monod developed such a formal structural system to understand evolutionary theory in Chance and Necessity. There are many such systems theories that are structural and formal as described in System and Structure by Anthony Wilden. The work of Gregory Bateson in Steps to the Ecology of the Mind is a good example of such formalisms based on logical type theory. Another valuable attempt at a general description is Stanley Salthe's Evolving Hierarchical Systems. But we will use here Klir's work as the touch

stone of our attempt to understand what happens when you conglomerate schemas together in an attempt to understand phenomena better. It is precisely this attempt of combination of schemas that marks modern scientific theories. What is different about Klir's work is that it is abstracted from any particular discipline and thus is on the level of abstraction with General Systems Theory except that it gives some architectural meat to this concept. The criticism of systems theory up to Klir is that it really had no content, other than saying everything is a system. But with Klir the permutational architectural possibilities of systems were explored at a level of generality that was unprecedented giving content to the System by making it both formal and structural at the same time.

What we need to understand is that each template of understanding gives some leverage on phenomena that the others lack. Thus the form as a schema has been used in geometry since the Greeks and in Logic as a basis of proof which is the strongest claim that understanding can make concerning anything. But forms are static and cannot deal with time. In order to deal with time structural, pattern level, explanations were developed that were not as strong as proofs but offered to deal with discontinuities in time seen in phenomena. Beyond these structural explanations there is an even weaker form of understanding that is description. It is with description that systems come into their own as ways of understanding things. The rule is that if you cannot prove you explain and if you cannot explain you describe, and this is the maxim of Science that we all live by. And what is best is if you have a theoretical viewpoint where you can switch between these different approaches to understanding phenomena at will, and thus is born the formal structural system that is a combination of all these schemas into a single over arching theoretical framework. Klir has built such a framework and the interesting thing about his framework

is what he calls the epistemological levels which has different levels of understanding that can be applied to phenomena. These include the object system which is out there in the world. Then there is the source system from which we pick out the various attributes we want to consider in our system boundary. Then there is the data system in which we begin to measure those attributes. Finally there is the generator system that allows us to simulate the data values changes rather than merely observing them. If you can simulate those changes then you can claim to understand them. But what is interesting about Klir's epistemological hierarchy is that it splits between what he calls the structural and the modeled aspects. The structural aspects has to do with the algorithms that model changes in data values and the model level has to do with changing those algorithms discontinuously. Both the structural and modeled sides of the epistemological hierarchy interact so that you can get a hierarchy of meta-levels of structures and models, and also the chiasmic interplay between structures and models at the various levels of the hierarchy. Now my interpretation of Klir's scheme which is controversial is that structures have to do with discontinuities in space while models have to do with discontinuities in time, and so I call the former structure and the latter flux, in order to differentiate it from either flow or process. I believe that the interesting thing about Klir's epistemological hierarchy is that he allows various levels of structure and flux and the chiasmic interaction of them at the infinity of meta-levels that are possible for them to interact at.

I would like at this point to draw attention to a similar idea that is put forward by Baudrillard in Critique of The Economy of the Sign in which he says that there is a similar hierarchy between value and sign in commodities. I have developed a theory that the work of Klir and Baudrillard should be considered complementary and that we should think of structure/flux hierarchical

chiasm as the dual of the value/sign hierarchical chiasm and that the two complementarities together give some idea about the nature of pattern as an emergent schematic level. Just as there is at the level of the system schema the process/system//gestalt/flow fourfold there is at the level of pattern as structure/flux//value/sign fourfold. These two schemas occur on either side of the form schema that has the fourfold complementarity of form/behavior//state/interface. These fourfolds at each emergent ontological level of the schemas define the nature of the various templates of understanding that we can apply to things through our projections. After projection there is reification and objectification in which these very templates impinge back on us as projectors after we have developed the differentiation from them by being subjects in relation to their objects. In reification the subject/object distinction is established mostly through subject vs. subject, or intersubjective politics based on will to power. Our objective is to understand the schemas themselves as projections prior to reification. The complete story of the formal structural system can be understood as the conjunction of the system, form, and pattern schemas in their fourfold complementarity which involves the chiasmic intertwining of their fourfold facets similarly to the way Klir describes in his epistemological hierarchy.

Now what we would like to do is introduce the vocabulary of Hilary Lawson in his book Closure as a way to unify the description of the process of schematization. His book seems as an attempt to make Deconstruction of Derrida palatable to the analytical philosophers. Often these cross border attempts to unify these warring philosophical camps are the most fruitful for the understanding of global philosophical issues. Lawson has taken the concept of the "Clearing of Being" which was developed by Heidegger as the space created by the ecstasy of Dasein and has called that openness. Then

he describes all schematization as Closure. Closure is a process by which openness is defined which produces a material and texture. Material is a particular form of schematization, and Texture is the inherent openness within a particular sort of closure. A closure is just one possibility of projection and reification which leads to objectification. The concept of closure combines all these stages of the dialectic described by Berger of Social Construction leading to alienation into a single moment that is the antithesis of openness produced by the ecstasy of Dasein as a lighting of Being within the clearing of the world produced by Dasein. Closure is the construction activity that is opposite deconstruction. Deconstruction takes us back toward openness from a particular configuration of closure. However, Lawson's explanation is too simple in the sense that he does not differentiate between the projection of schemas and the discovered things out in the world upon which the schemas are projected, i.e. he does not distinguish between the ontic physis of the things themselves and the ontological logos of the projections. Instead he constructs a monism which hides this interaction that is so crucial to science. He is talking about the end product, the objectification in which this difference between subject and object gets papered over again after having appeared at the point of reification. He calls that objectification 'material' and the surplus of openness that is still left over despite closure as 'texture'. His is an interesting take on the problem of how to describe after the fact the result of schematization, and the fact that it may be undone, de-solidified, and resolidified in another crystalline formation that is completely different. Such transformations of closures at a particular level of differentiation of material are called emergent events. He does not realize that all emergent events need to bring to bear all the kinds of Being in all their aspects in order to be genuine. In his monism Lawson is not making what we think are crucial distinctions, but it is useful to have a

monistic terminology occasionally to show that the process of schematization can be described in a way that is unified and totalized as a dialectic between closure and openness, or between 'material' and texture. Lawson provides a nice balance to the distinctions that I believe are crucial for understanding how the interaction between physis and logos works in our tradition as exemplified by science by defining what we mean by the end product of construction as closure as the opposite of move back toward openness of deconstruction. We will reserve the right to appeal to this vocabulary occasionally in order to make the point that a unitary and totalizing perspective can be taken toward schematization that results in a monism of closure rather than our emphasis on dualism and pluralism which is postmodern rather than analytical in emphasis.

A Combined Theory Emerges

Our aim has been to broaden the perspective on Systems Theory by first introducing its dual in Process Theory but also fitting it into an emergent ontological hierarchy of other lower level schemas including Forms and Patterns. In this way we reiterate the model of the Formal Structural System but place it in a wider context. In this context we see that patterns come in four different kinds, including value, sign, structure and flux. These appear not just as separable types of pattern but as chiasmic interwoven and braided forms the most complex of which combines all four. Patterns are the contents of forms to which shape is added, and that shape is the topology on which the patterned content appear. For the understanding of shape, as a type of form, we appeal to the work of Michael Leyton in Symmetry, Causality and Mind. Leyton gives the rules for the deformation of shapes. But shape also has a verbal aspect as well as a nominal aspect. In other words "Shape Shapes". It is one of those English words which can serve as both a noun and a verb, and thus represent the monolith with static and dynamic aspects. The dynamic aspects we see in terms of the behavior of the form. Objects, as found in object oriented software design, are combinations of form and behavior. But in such objects we must consider both their internal states and their external interfaces which are normally defined by contracts. The form level is defined by object oriented software design techniques better than by any other definition. But forms are traditionally seen in Geometry and Logic and in other similar formalisms. Thus there are many types of forms which this classic schema covers. Pattern only came very late to mathematical definition while form was defined early through mechanical draftsmanship, and as parts mechanical apparatuses. Behavior is seen in terms primarily in terms of motion of mechanical parts with finely machined forms. The best example of a mathematical formulation of pattern is found in the work of Grenander such as Pattern Theory. Patterns appear on

the surfaces of forms which have their shapes independent of their content. So patterns nest into forms but are independent of them. The different types of pattern, i.e. structure, flux, value, sign are related to the types of generators of patterns. Some patterns are generated by discontinuities of space, others of time, others of values, and others of significations. Values relate to the states at the formal level, Signs relate to the interfaces at the formal level, Structure relates to shape at the formal level, and Flux relates to Behavior at the formal level. In other words there is an homomorphy between the elements at that formal level and the pattern level.

The same is true of systems. Systems are made up of forms that appear as figures in gestalts on the background of the other possible figure-ground relations. When we say that a system is made up of entities and their relations, we normally mean by entities forms if not full fledged objects. The relations are generated by the structure preserving behavior of the forms within the system. System state is at its broadest summation of the states of the objects within the system. The system interface is made up of at its broadest a summation of the interfaces of the objects in the system. The system behavior at its broadest is made up of a summation of the behavior of all the objects within the system. When we view a system we will see a specific figure on the background of the entire set of possible figures and their grounds. When we say a system is a social gestalt we are including all these possible views by different individuals in our definition of the system. But the system as such is the conceptual equivalent of this set of views in which they all cohere as a noematic nucleus. And that system has an associated process made up of the sum of the behaviors of the objects within the system interacting with each other and its environment across the system interface. At the system level we distinguish between noesis and noema, but this distinction also

applies at the formal level where the system state and interface is noetic while the shape and behavior is noematic. This distinction also exists at the level of pattern where structure and flux is noematic while value and sign is noetic.

When we take these nested schemas together we can apply the categories of plurality, unity, totality and wholeness to each of them, and we can see them in the context of the aspects and kinds of Being. There are a plurality of patterns, forms and systems. But when ordered they can exemplify a certain unity of pattern with respect to sign and value, unity of form with respect to state and interface contract, unity of system with respect to system and process concentrating on their noetic aspects. However, when we talk about totality we would tend to talk about the noematic aspects. There is the totality of structure and flux at the pattern level. There is the totality of behavior and shape at the formal level. There is the totality of gestalt and flow at the system level. But at each level the combination of unity and totality tends toward the non-dual of wholeness which is the contradiction to plurality in the Greimas square. Unity and Totality are themselves contradictions as well in this scheme. But the entire square brings together both contradictions and contraries into a synthetic whole which is the completion of the dialectic. Now each schema is something that can be said to have being, which is glossed by the abstract stasis of Pure Being. This is what we think about when we consider abstractly patterns, forms and systems. But we immediately find that each has an exemplification at the next higher meta-level which is Process Being which occurs in terms of structure and flux for patterns, behavior and state change for forms, and process and flow for systems. What is more difficult to think about is the fact that the difference between the complementarities at each schematic level participates in the differing and deferring at the trace trace level of Hyper Being and in

the chiasm of the flesh at the propensity level of Wild Being. In other words each fourfold schema has a depth to it which is an unexpected conundrum. It is that conundrum that confounds us in many cases as we deal with systems. That is why we must attempt to understand these higher meta-levels of Being and how they impinge on the types of patterns, forms and systems we are trying to create. We must also attempt to understand how they relate to the various aspects of Being which are truth, reality, presence and identity. The relations between these give us the fundamental properties of any patternism, formalism, or systemism. These fundamental properties are well-formedness (clarity), completeness, consistency, coherence, verifiability, validity. They can be applied to each level of schema and between levels. Because the schemas participate in the showing and hiding of the metaphysics of presence, of identity, of truth, of reality, i.e. of logocentrism established by Plato. We describe in terms of what is present, we explain in terms of identity across discontinuities, we prove in terms of the establishment of truth and we indicate reality. Reason is the application of all of the aspects of Being together. Opinion is their exercise independently. As Plato said using his divided line analogy Reason may be representational or not representational as Opinion may be founded or unfounded. When we use the aspects of Being together we concentrate on the interrelations of the fundamental properties. Founded opinion is one for which there is a basis. The best basis according to Plato and Aristotle is reasoned basis, rather than say prophecy, or oracles. But we must remember that the representational intelligibles are just part of what may be reasoned about like order and rightness, and the non-representable intelligibles such as fate and the good are the goals of the highest thoughts. Non-intelligibles such as the sources and root of things mark the limits of thought.

Now this combination of the foregoing

elements gives a much broader systems theory than most sources within the tradition. It is cognate of the relations between the schemas, the categories, the aspects and kinds of Being and how these all play together to give us a basis for understanding systems theory more widely than normally encountered in the literature. But all this is merely a starting position. It defines the metaphysically mature systems theory, that takes into account other schemas and takes into account the various aspects and kinds of Being that act as the ground of our systems theory. The ground is not a simple plenum as once believed. The explanatory devices are not fused but nested as various schemas. And the operation of our reason on the grounds must take into account all the aspects and fundamental properties of Being. But all this differentiation in fact provides us with tools for understanding the complexity and opacity of the systems that we encounter and attempt to build. The fact is that systems are difficult to create, and produce and maintain, and without these differentiations we would have no handle on describing those difficulties and obscurities. In fact, this account begins to give some hope of understanding the difficulties we face as practitioners rather than brushing them under the carpet, until we cannot suppress the unintended side effects, the opacity, the difficulties, the impossibilities that are continually encountered in systems engineering practice. Engineers overcome or are stumped by various vagaries or even extreme challenges every day. Should we not have a vocabulary for describing these difficulties rather than one that attempts to gloss over them and forget them as the current naïve vocabulary of objective systems engineering, the dominant paradigm, does? When you read current systems engineering texts they tell you what to do, which is handed down as experience from previous generations of experts in the field, but they do not tell you why it is that way. There is no grounding of the field attempted. Here we appeal to systems theory as the

grounding of the field of systems engineering. But beyond systems theory we appeal to ontology as the grounding of the theory. Because of this grounding in modern ontology we can explain why systems are so difficult to build and the relation of the schemas to the ontic physus that they are projected on by the logos. We can give an in depth view of these explanatory foundations and show how they impact our ability to produce systems and the creation of chaotic or indeterminate results by our well intentioned and determinate efforts. We can explain why such systems will always be non-routine and how they can never be reduced to routine processes. Thus we get a view why Systems Engineering is hard. That hardness is intrinsic and will never go away but will in fact only increase as the systems become more complex. So this is a view that you need only if you want to contemplate the impossibilities, and intrinsic difficulties of complex systems engineering. That is to say if you want to think about the future of the discipline in a fundamental way.