Anti-terror Meta-systems Engineering

PREEMPTIVELY USING HOLONOMICS AND DEVIANT LOGICS TO THINK THROUGH THE VULNERABILITES OF THE TECHNOLOGICAL META-SYSTEMIC INFRASTRUCTURE

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From Systems Engineering to Meta-systems Engineering

In earlier papers I have tried to explain a new paradigm and perhaps a new episteme if not a new ontology for Systems Engineering practice. One of the ways of understanding this new approach is to use the extreme nihilism of terrorism as an example. What is necessary I have said is a move from Systems Engineering to something I call Meta-systems Engineering. Meta-systems engineering is the complementary inverse dual of Systems Engineering. It looks not at the system as social gestalt that is a whole greater than the sum of its parts, but at the environment or ecosystem of that system that is full of other systems which interact often in unexpected ways through the medium of the meta-system. That inverse dual is a whole less than the sum of its parts. It is a whole filled with holes, or niches, that systems fit into. Sometimes we attempt to talk about this using the phrase "system of systems". But this in effect merely posits the same schema, the "system", at another level of abstraction and hides the meta-system. Meta-systems are very different from systems. They are essentially different ontological schemas for looking at the world. Systems are unified syntheses while Meta-systems are deconstructed fields that are the background to systems which remain both perceptually and conceptually invisible for the most part, until the system breaks down. When the system does break down, then as Heidegger says, this background becomes highlighted[1]. That is what has happened in the wake of the terrorist attacks. This invisible background where safety and security is achieved or lost has come to the fore as an all-important issue.

Toward Understanding Nihilism Implicit In The Technological System

Meta-systems are disunified, detotalized totalities[2]. They are fields within which systems take shape and interact. One kind of system is the air travel system. Another kind of system is urban high-rise office complexes. We know that accidentally a plane might fly off course and hit a high building so we control traffic routes and place lights on the buildings to make them in effect light houses in the sky. But in all our safety and security planning we did not think of the diabolical connection between the car

[1] Technically in terms of Heidegger's philosophy in Being and Time the present-at-hand being-in-the-world is transformed into the ready-to-hand being-in-the-world modality of dasein (the *being there* of human beings).

[2] See Sartre's Critique of Dialectical Reason for the use of this phrase "detotalized totality" to mean the desconstruction of the project of totalization.

bomb and the high jacking, two anti-technologies that when put together make possible a catastrophe of gigantic and horrible proportions in the hands of the terrorists, an undesired emergent side-effect of our own designs. We merely failed to think broadly enough when we created our designs of these technological systems. We could have installed reinforced secure cockpit doors from the beginning but it did not occur to us. Until this happened even if they had existed the crew would have opened them in order to deal with the terrorists whom they would have assumed could not fly themselves and ultimately wanted to live. When we design systems we tend not to think very much about the environments or eco-systems that those systems will inhabit; especially extended environments like the entire technological infrastructure of our society and the geo-politics of the world. Also we don't plan very well our dealing with the side effects of our technological system. And thus the side effects many times comes back to haunt us causing deep and difficult to resolve problems, like global warming for instance. Unforeseen side-effects from the interaction of multiple systems that were all designed independently is a big source of problems in our society, even a source of catastrophe as we have now discovered. So we as Systems Engineers are called to make our systems *harder to infiltrate* in the future, to look at making them interoperate more closely and to close the security and safety gaps. But what we realize is that there are probably so many possible ways of using the technological infrastructure against itself that it is impossible to plan for and design around them all. And this brings us to the deeper problem nihilism at the heart of technology itself observed by many philosophers such as Nietzsche, Heidegger as summarized by Fandozi in his book Nihilism and Technology. The myriad views of the technological system and infrastructure that would expose all the vulnerabilities calls for a much higher level of Systems Engineering. We have had Specialty Engineering before, but now that part of our discipline needs to increase its vigilance a hundred fold in order to produce the kinds of robust systems that can reduce our vulnerabilities. What is called for is a further splintering of viewpoints and an intensification of the gaze from those viewpoints on the technological system itself and its infrastructure as it is being designed. That in itself can be seen from a philosophical viewpoint as an intensification of nihilism. The nihilism of our enemy works on us because it causes an intensification of the very splintering that we need to do anyway to produce the systems themselves. In other words the terrorism is a latent possibility within the technological society. In fact it comes from the technological society. Terrorism was ultimately first used in Europe against other Europeans as it is still being used today. Terrorism is the leveraged use of technology to produce death and destruction by so called illegitimate forces other than state institutions who believe they have nothing to loose in their fight against state institutions or the societies that support them. This misuse of the power of technology is an inherent possibility in the proliferation of the technological system itself. The technological system works on the basis of the fragmentation of viewpoints and the extreme of terrorism merely intensifies this fragmentation by creating yet more viewpoints from which we must consider our designs in order to fend off the misuse of the technological system. There is an endless escalation in that splintering of viewpoints that are the inherently nihilistic aspect of technology itself. We are ultimately forced to wonder if intense vigilance from a myriad disciplined points of view is sustainable. We cannot watch everything all the time. We cannot consider all the possible misuses of technology. We are going ultimately to accept some level of risk. The question is how much risk will that be in an environment where the diabolical are running amok.

Schema Theory and Schema

Engineering

One way to approach this effort is to change our understanding of Systems Engineering and attempt to increase our sensitivity to the environments and ecologies of our systems, which are fundamentally different from systems, and which I have called "meta-systems." We need to do that any way because of global environmental concerns. Now we have a new reason to consider the hidden interstices between our designed systems, that is to promote safety, security and to make our systems more robust in the face of threats from terrorists. 'Meta-systems Engineering[3]' leads us beyond the schema of the 'system' into a hierarchy of several different schemas that are all different and unique ways of organizing and understanding what we find in nature.

In general that calls for the development of what I have called Schema Theory and the practical application of that might be called Schema Engineering. In this case the set of schemas are ontological levels of order that we project onto the ontic world beyond ourselves. The schemas I have in mind are as follows:

Pluriverse[4]
Kosmos[5]
World[6]
Domain[7]
Meta-system[8]
Systems[9]
Form[10]
Pattern[11]
Monad[12]
Facet[13]

This hierarchy of schemas is the various kinds of *models of order* we project into the phenomena we apprehend. The phenomena in itself has various levels of emergent ordering which we discover through the projection of these schemas. I am not saying that these are the only schemas or that the schema set is exactly ordered in this way. This series is an example, a trial model that shows how the nesting of schemas might be ordered. What

[3] See INCOSE 2000 paper by the same author of that title.

[4] See David Deutsch's The Fabric of Reality. The pluriverse is the intersection of all existent universes. This schema is beyond our experience.

[5] The Kosmos or Universe is the subject of scientific exploration. This began at the dawn of the Metaphyical ear with the work of Thales and Anaxamander. Anaximander was the first to write prose, to create a model of the cosmos and a map of the earth. This schema is beyond our direct experience.

[6] The world has been defined by Heidegger as the furthest horizon of our direct experience. Husserl called that the lifeworld. The world is the coherence of everything that we experience.

[7] The world that encompasses everything is splintered in to domains or disciplines that have different perspectives on phenomena.

[8] Also this schema might be called the archon because we have no good term for it. It is comprised of contexts, situations, milieus, environments, ecosystems, etc. They are fields within which systems arise and interact.

[9] Perceptually this is the level of the social gestalt characterized as a whole that is greater than the sum of its parts composed of figure and ground. Usually defined as a set of things and their interrelations or interactions. But this definition is analytical and does not account for the wholeness of the system. See Rescher in Cognitive Systematization who considers the organic metaphor that grounds our idea of systems.

[10] External Shape of an object. This level includes not just the external shape but also its behavior as in Object Oriented design.

[11] Value, Sign, Flux and Structure are various kinds of patterning of content. This is the lowest level of our experience and is dependent on the lowest level of articulation by our instrumentation.

[12] The datum of the content itself at what ever level of resolution. This is the limit of our direct experience.

[13] The facet is beyond our direct experience. It is an inner determination of difference within the phenomena itself, seen within itself without the projection of our schemas. Thus this is the null schema. It is the difference beyond the resolution of our instruments.

we really need to do is research this inward horizon and attempt to determine the nature of these schemas and how they differ from the ontic ordering of the phenomena that is discovered by science in the rebound from the projection of our schemas, i.e. through the anomalies that show up in the aftermath of the projection of the schemas onto phenomena. For the most part we tend to mix up our schemas with the actual discovered ordering of the phenomena. We assume that systems are "out there" in nature and we forget that they are imposed organizations. In other words our minds and perceptual organs have a natural harmonic inbuilt ordering that is projected on all phenomena and we think that our seeing and understanding is neutral so that the projected order becomes hidden in the midst of the different discovered order. But in actuality we need to separate the projected order from the mix of orderings so that we get a view of things that does not have an anthropocentric bias. Schema theory is a way for us to make that separation. But it is also valuable because as Systems Engineers we also design systems, meta-systems, domains and worlds. Our designs are based on the schemas we project as context and content of what ever we are focused on creating. Our design is in fact at its core the embodied projections. So the schemas are the basis of our Engineering work. Therefore to understand our own design processes it is important for us to understand the schemas that are the basis of our projections that give coherence to our designs.

We tend to think of the mathematical categories as the basis of our designs and our perceptions of order in nature. But in the last fifty years or so a new kind of Mathematics called Model theory has shown us the important relation between universal algebra and logic. This allows us to begin to model mathematically the models and theories that underlie our mathematical understanding. Schema's theory is something of a higher order beyond the models and theories of mathematical categories. Schemas in fact inhabit a middle ground between these theories and philosophical categories. Aristotle and Kant have developed the most famous tables philosophical categories. For my own part, I prefer the modern category theory of Igvar Johannson articulated in his book Ontological Investigations that is based on the Logical Investigations of Husserl as a starting point. These are an attempt to articulate the highest concepts and their differences and interrelations. Schemas are particular constellations of these highest concepts like the difference between quality and quantity, unity and totality, etc. in fundamentally different emergent orders. Beneath the level of the schemas are the concrete theories we produce in science based on the implicit ordering of the schemas we project on nature and ourselves. Philosophical categories and Schemas are important for us to understand in order for us to comprehend the relation between our theories of phenomena and the phenomena themselves. The phenomena always go beyond our schemas. But the schemas are the basis for our understanding the phenomena. It is in the difference between the implicit schemas and categories and their anomalous violation that our theories come to actually reflect the world. But on the other hand, our design work is directly founded on the assumption of the schemas and ultimately the philosophical categories. If we did not have the schemas we would falter because our designs would fail to have inner coherence. We might have multiple theories or designs from various perspectives. But the schemas bridge the various theories and designs by providing and underlying unity of understanding, which is in turn based on the fundamental concepts, provided by the mind. If it were not for the schemas and categories implicit in our thinking about designs and theories of phenomena we would not be able to communicate rationally with each other. Understanding the foundations of rationality is a first step in comprehending the irrational.

The Technological Systems and the Technological Infrastructure

Systems Engineering needs to disentangle its projected schemas from the phenomena. This is like our assumption that no one would want to hijack a plane and commit suicide by flying it into tall buildings intentionally. We built this assumption of basic humanity and rationality into our designs of the technological infrastructure. Our view of what we were building stopped at the aviation system and the building system. We did not think of the *system of systems* that included ***both*** with a view toward our vulnerabilities with respect to those who did not share our fundamental assumption that life was preferable to death and that intentional mass murder was unthinkable. Now we have to rethink all our systems in terms of the "system of systems" to which they belong. When we say "system of systems" we are actually projecting a nesting of systems within systems. However, by doing that we are missing something implicit, another schema that lies above that of the system. Just as there is a form as a figure on the background in the whole of the gestalt, there is a deeper background on which the gestalt of the system is seen. That deeper background is called the *proto-gestalt* when viewed perceptually and it is called the meta-system when thought about conceptually. The meta-system is what comes of thinking of the term "system of systems" not in terms of nesting of the same schema inside itself, but in terms of taking the system to its meta-level, i.e. beyond itself to a new level of emergent organization that is different from the system. "Meta" can mean either above or beyond. Here we use it in the sense of beyond, but beyond to something different, a different level of theoretical organization that lays outside the system and it's the complimentary inverse dual of the system. This taking of the system to its meta-level where we are talking about a different essential structure needs to be further explored in terms of its significance to Systems Engineering.

If we merely look at the nesting of the systems within the higher order system, say the air transportation system and the high-rise office buildings of the urban system within the greater technological infra-structural system, then we are going to miss essential features of the landscape of the infra-structure that only theories based on meta-systems can comprehend. Meta-systems do not work like Systems. We know that from our development of computer software systems because there we explicitly develop meta-systems called "operating systems" within which the various lower level systems we call "applications" inhabit. The infrastructure is not merely a passive landscape that holds the various large scale technological systems. Rather the infrastructure is more like an 'operating system' that provides resources and the arena within which these other large scale technological systems interoperate. The paradigm shift we see in the terrorist attack of September 11th is that they realized this interdependency in a way that the designers never dreamed of. They saw that they could introduce an anti-technology very easily into the vulnerabilities of the designs of the technological systems that were part of the infra-structure, because the meta-system was left undesigned. This is a general problem with the entire technological infrastructure around the whole world. The technological infrastructure as such, as a meta-system, was left undesigned. Why? Because we cannot see it with our theoretical or design gaze. This is because we have no general theory of meta-systems other than that which we are given by the discipline of ecology. And in that case we are talking about the meta-system of nature and not designed meta-systems such as we see in "operating systems" for computer software applications. The term "operating system" is unfortunate because it suggests that its object is a system schema when in fact it is another kind of

schema all together that is the complementary inverse dual of the system schema, i.e. the meta-system. The relation between the system and meta-system is precisely the same as the relation between the Turing machine and the Universal Turing machine. A Universal Turing machine is an "operating system" for Turing machines. Universal Turing machines make it possible to read Turing machines from the tape of a Turing machine and instantiate them one after another. In this sense there is a Turing machine inside another Turing machine. This nesting is not just a system inside another system but has another implicit sense in which the coherence of the nested schema inside itself has a different essence from the un-nested schema. Saying the word "system" twice in "system of system" actually produces something quite different from the system not involved in such a nesting. This is in fact what Godel discovered in his famous incompleteness proof. His proof counts mathematical elements, i.e. turns the counting system against itself and shows that systems are intrinsically incomplete. I.e. there are undecidable statements that cannot be placed definitely inside or outside the system. Some statements of a formalism stand undecideably right on the boundary of the system. This is seen in the foundations of the formal system itself where different variations of a single axiom produce complementary formalisms. Incompleteness at the boundaries and complementarity of the axioms of formal systems are our hint that meta-systems exist where we try to bend back the system on itself either at the level of axioms or at the level of the boundaries of the system.

Think of it this way. A system has an inside and an outside. The inside of the system is in effect the complementary inverse dual of the outside of the system. When you place a system inside another system then the outside of the system has a very different relation to the inside of the encompassing system. Suddenly the system is within an environment of the encompassing system and that is experienced as a meta-system. Meta-systems are like the turning of the system inside out, or better yet like the deconstruction of the system into a field. Nietzsche said words to the effect that Subjects are Objects (forms) turned inside out. Similarly, at a different schematic level meta-systems are systems turned inside out. We call the discipline that looks at the duality of systems and meta-systems holonomics after the holon of Koestler which is both part and whole at the same time. The system within the meta-system is a whole greater than the sum of its parts within a whole less than the sum of its parts[14].

We are not used to making the sort of paradigm shift both in our perception and our conceptions to view the complementary inverse dual of the system schema. But the terrorists have managed to do that. The unimaginable quality of their deed comes precisely from making that shift. So now we need to make that shift ourselves in order to counter their evil intent as best we can. We need to begin to design the meta-system of the technological infrastructure, and not merely by considering it a 'system of systems,' i.e. in terms of the outward aspects of one system within the outward aspects of another system. Because when we do that we miss the field-like qualities of the meta-system that flows in between the two nested systems. Rather we need to concentrate explicitly on those features of the meta-system that are normally hidden from our design or theoretical gaze when we look at our own technological infrastructure. We need to understand the essence of meta-systems and how they are different from systems. Until we understand that difference and use it to see the vulnerabilities that are normally hidden to us, then we will remain vulnerable. The technological infrastructure needs to be redesigned as an "operating

[14] See the paper 'Meta-systems Engineering Futures' for more information on holonomics.

system" for the various technological systems that it comprises rather than remaining a passive undesigned landscape which is merely the hinterlands between the various designed systems. It is in these hinterlands and in these interstices that the terrorist has learned to strike. We must learn from our experience of designing space worthy environments, where every gap is seen as a possible weakness for the breach of the atmosphere of the spaceship or space station. In other words, when we design for space-travel we consider all contingencies within the integration of the various technological systems that make up the entire architecture of the space environment. We need to begin to design earth systems the same way only with a view to the various ways that the technological systems within the technological infrastructure can be used against one another to produce gaping vulnerabilities that might be exploited by others. We have already learned this lesson with our computer systems which are hacked into and compromised. However, up to this point hackers mostly destroy or steal data, rather than committing mass murder.

We have said that the system and the meta-system are essentially different. It behooves us to mention some of those differences. However, when we do that we are entering a very ill understood territory where much work needs to be done in order to firm up these hints and produce a robust theory of meta-systems to complement the general systems theory that has been created over the years. One of the basic aspects of meta-systems as pointed out by Arkady Plotnitski in his book Complementarities is that Meta-systems are made up of "complementarities of complementarities." Notice here is a doubling again like that of the "system of systems." This shows that we are again in the *beyond* of the meta-system where there is an intensification that goes beyond the mere doubling of the concept. In the English language prior to the seventeenth century it was meaningful to repeat negations, superlatives and other constructions what grammarians eventually decided were not meaningful. Now we say that two negatives make a positive because of the decision to have that as a rule in the restricted economy of classical logic. But prior to this the repetition was considered meaningful and there are examples of up to four negatives in a sentence in Chaucer. This phenomena where repetition produces intensification, not cancellation, is something that is operative in meta-systems as a way of thinking as opposed to the systematic way of thinking. We talk about the logical system in which two negatives make a positive. But on the other hand there is the moral system where two wrongs don't make a right. We recognize that morality is a meta-system where there is intensification flowing from repetition. So when we talk about "complementarities of complementarities" that appear in the meta-system much like the way that they appear in the scientific philosophy of Bohr, there is a sense that this intensification of complementarity is something different from a particular complementarity nested in another. In fact the intensification leads us to the nature of the field that allows itself to be folded back on itself in the nesting process. That field has the properties that Bohr posited which is a sustained superficiality that indicates there is nothing behind the complementarities themselves. Bohr posited that there was nothing like Bohm's 'pilot waves' beyond the tissue of complementarities themselves, and he was vindicated by the tests of Bell's Theorem where there is action at a distance between complementary particles without any medium producing the action at a distance that may be discerned. This strange characteristic of nature which quantum mechanics puzzles over but finds substantiated in physical experiments makes clear that we can either look at the thing (particle) or the field (wave) effects of any particular entity. When we move from looking at the system to the meta-system we are making a similar complementary transformation of our

theoretical vision. The field of meta-systems is a superficial tissue of complementarities of complementarities with indefinite nesting with nothing behind it grounding its phenomenality. In fact, the way we know our system has reached a meta-systemic field and interacted with it is that there is demanded by that field a complementary action. For instance, read and write when software interacts with the operating system. The designs of our systems are constrained by these implicate complementarities of the meta-systems that they inhabit.

The meta-system acts as a filter on the systems that inhabit it. We see the meta-system as having four complementary aspects of origin, arena, source, and boundary. Origin and arena are complementarities as are Source and Boundary **and** the two pairs form a higher-level complementarity. Systems that appear within the meta-system all have points of origins within the medium of the field. Until they reach the sinks of their destinations they interact within the arena of the meta-system. During this interaction meta-systems provide resources for the systems that inhabit them and they impose constraints on them. These constraints are a form of testing regime that will reject systems from niches within the meta-system that do not conform to the interfaces of the meta-system. All meta-systems themselves have boundaries beyond which other meta-systems exist. Also they have sources, like template objects, from which the systems inside them are derived from prior to instantiation. Understanding the complex interplay of complementarities that make up a meta-system out of the facets of origin, arena, boundary and source is the key to explaining how systems interact within the meta-system. When we double the meta-system, i.e. look for the *meta-system of meta-systems,* then we discover the domain. Doubling the domain gives us a world and so on up the ontological hierarchy of schemas. We inherently understand this. When the terrorist hijackings occurred we immediately looked for the origins of the plot and sought out its sources. We understood that the whole globe was the arena in which the terrorist networks lurk but we could trace back its source to Afghanistan where we sought to destroy that terrible scourge of humanity. However, we realize that terrorism is a world wide phenomena and that there are ultimately no boundaries for it on the globe of the earth. By default the third world war becomes a global war against terrorism worldwide which intensifies the need for a new world order in this case dictated by the Western powers. In other words by the very fact that the terrorists killed themselves in the act of committing their crimes against humanity, we are led to think about the meta-system that caused that phenomena to arise, i.e. global terrorist networks and states that harbor them. We immediately turn to the meta-system when the system vanishes. The meta-system is highlighted when the system fails or disappears.

General and Restricted Economies

Plotnitsky brilliantly connects the concepts of Bohr concerning complementarity with that of Bataille concerning the difference between General and restricted economies. Meta-systems are *General Economies* as opposed to the *Restricted Economies* of Systems. Bataille attempted to rethink political economy on the basis of the anomalous political organizations found around the world from an anthropological perspective. He realized that what we normally think of as the rational economy was extremely limited and that it was many times embedded in a greater economy which was not rational. When Aristotle called us rational animals he defined us in terms of an ideal. But much of what human beings do is utterly irrational, a fact that the terrorist attacks brought home very clearly to us. The general economy is irrational rather than rational. Rational means that reasons are given for action.

Reason is to action what Logical proof is to thought. We deem suicide bombing as irrational. When the suicide bomber wears a whole airplane instead of merely some packs of explosive and aims at large buildings we think it monstrous irrationality. This is a characteristic of the negative use of the general economic way of looking at things. Bataille gives the example of the potlatch of the northwestern Indians where social value was gained by the destruction of wealth. Bataille uses the example too of the Aztec Indians who killed myriad people in succession by tearing out their hearts in order to give life to their gods. Irrationality moves from the gross destruction of commodities to the gross destruction of human life very quickly. But we must remember that these irrational transformations are ways of producing transcendental value in those societies. Honor goes to those who can destroy the most wealth. The eternal life of the gods is made possible by the continual sacrifice of human beings. In the case of the terrorists personal entry into paradise[15] and the change in the world is produced by their act of supposed altruism[16]. However, we have the sense that these irrational ways of acting are at the same time merely utterly chaotic or completely incomprehensible when we look at them from within the restricted economies set up by reason. Rather, the meta-system has its own essential structure that is fundamentally different from the reason and logic that we normally appeal to. In order to understand that we must produce something like model theory but inverted and at a higher level of generality. Model theory is the combination of universal algebra and classical first order logic. What we need instead is a kind of theory that combines meta-systems theory which is rooted in universal algebra and a kind of non-classical logic that comprehends the structure of paradox and absurdity. A good logic for us to use in this case is that of Hellerstein called Diamond[17]. What we want to do is consider universal algebra very generally to include all the hyper-imaginaries and the various levels of algebraic ordering including the real, complex, quaternion, octonion, sedenion and infinite degrees of non-division algebras. It is these algebraic structures that determine the inherent ordering of meta-systems theory, and it is these differences in algebras that produce the Special Systems[18] that are embedded in meta-systems. The algebras relate to reason through countability. Counting is a fundamental perceptual and motor action which gives us the basic sub-structures for the differentiation of our concepts. But we go beyond counting when we manipulate these distinguished concepts

[15] Paradoxically this is false from the point of view of their own religion. Because they have violated fundamental precepts of Islam their reward in terms of the laws of Islam is endless repetition of the suicide and residence in the fire of Jehannam because of killing innocents and for a myriad other fundamental violations of Islamic law entailed in their actions. In fact, it is the passengers and other victims that become "shaheeds" or martyrs. The Prophet Muhammad said muslims should not use the punishment of God as a means of killing, i.e. fire and burning. Those caught in calamities such as earth quake flood or firestorm become shaheeds. Even Pharoah becomes a shaheed when he is drowned in the red sea after pursuing Moses. By a strange absurd logic the violators go to hell and their victims go paradise even by the rules of their own religion which they have defamed in attributing their action to it.

[16] What is amazing is that they truly did change the world. But instead of America collapsing it was strengthened and became determined to rout out global terrorism. This was an unintended side effect of their action that they did not foresee. Change the world they did but not in the way they had hoped.

[17] Hellerstein, N.S.; DIAMOND: A Paradox Logic (Singapore, World Scientific 1997)

[18] See 'Meta-system Engineering Futures'

in language by the structures of logic[19]. But traditionally we have not accepted logics that comprehend paradox and contradiction, so called para-consistent logics. But in order to understand things like the absurdity of terrorism we must admit that such deviant logics exist. When we combine universal algebra with paradoxical logic we get something that might be called meta-model theory, i.e. a theory that goes beyond traditional model theory developed by mathematicians by opening up the grounds of the restricted economy of their theory. We would do that by including not just models of mathematical categories, but also the implicit schemas and categories that underlie those models as well as deviant logics. Meta-model theory is a theory of the nesting of model of models or a schema theory. The schema of schemas is in turn a philosophical category theory which with one more step leads us to the level of ontology. Ontology supplies us with an understanding of the various kinds and aspects of Being as an ultimate foundation for our understanding of the various kinds of schemas.

Here we would like to pause and point out that at the ontological level there are both different kinds of Being and different aspects of Being. The kinds of Being come from the intensification of Being itself through the process of repeated interfolding to produce Pure[20], Process[21], Hyper[22] and Wild[23] Being. Each level of intensification has a different emergent characteristics[24]. But also at the level of Being are the aspects[25]: truth (x is y), reality (x is), identity (x is x) and presence (this is x). As I have shown in previous papers the relations between these aspects are properties such as consistency, completeness, well-formedness (clarity), coherence, verifiability, validity. Normally formal systems only deal with consistency, completeness and clarity. When we add the aspect of reality then these new properties that we know so well in Systems Engineering become important, i.e. coherence, verifiability and validity. Model theory connects validity and consistency. A valid statement is deemed true. A model is specifically the target of a consistent and true set of statements in first order classical logic. It is of course, incomplete according to Godel when considered as a system. At infinity coherence is achieved at the semantic level and this is called a theory. This suggests that there is a similar connection between completeness and coherence in relation to theories as well as a connection between clarity and verification. In other words we extend model theory which attempts to model semantics in parallel to the syntactic level by the interjection of reality as a test. Injection of reality has as its opposite the achievement of coherence at infinity. Instead of focusing on just three aspects of Being as normal model theory does we interject the fourth aspect which is normally forgotten. That interjection causes our logic to be fundamentally different because now it is necessary to extend our truth values beyond

[19] We include here not just syllogistic but also pervasion logics developed in India and China which are the dual of the classical Western logic.

[20] Called present-at-hand by Heidegger in Being and Time.

[21] Called Ready-to-hand by Heidegger in Being and Time.

[22] Called the Hyper-dialectic of Process Being of Heidegger and the Nothingness of Sartre by Merleau-Ponty in The Visible and the Invisible. Called Being crossed out by Heidegger. Called Differance by Derrida in Of Grammatology.

[23] Called Wild Being by Merleau-Ponty in The Visible and the Invisible. Dealt with by Deleuze and Guattari in Anti-Oedipus and Thousand Plateaus. Discussed by John S. Hans in The Play of the World.

[24] These were explained in the INCOSE 2000 paper called Meta-Systems Engineering by the author

[25] These are the grammatical uses of the word "Being" in the Greek philosophical language that persist today in most Indo-European languages. These are the only languages that include the concept of "being" in their grammars.

the traditional true and false and perhaps the both and neither of deviant logics. Now we need to consider also the values real/illusory, identical/different and present/absent as well. So ultimately the Diamond logic of Hellerstein based on G. Spencer-Brown's Laws of Form, will have to be extended into what I call a **Vajra logic** that includes all the aspects of Being beyond just truth and falsehood.

Diamond Logic comprehends the paradoxicality and absurdity of terrorism. It posits that there are two fixed points identified by Spencer-Brown as ***i*** and ***j***. Hellerstein interprets them as *true, but false* and *false, but true* in a dynamic system where there are repeating truth values. **True** in this scheme means *true but true* and **false** means *false but false*. Hellerstien gives the example of the circuit that produces the buzzer. The twin paradoxes **i** and **j** are like two buzzers. When these are interleaved as inverses of each other they produce an illusory continuity which is the equivalent of absurdity. The illusory continuity of the idea has as its implicit infra-structure the absurdity that bifurcates into paradoxical duals. Paradox raised to the power of paradox can be seen as an oscillation or circulation among paradoxes. So for terrorism this is the paradox *alive but dead* which is transformed into the paradox *dead but alive*. In other words the terrorists enter a liminal state where they are socially considered already dead and that is what allows them to carry out the destructive acts that will produce value in the meta-system in which they will be transformed into dead but alive in deviant paradise of their own which we consider hell[26]. Liminal states are not comprehended by normal classical logic, even less does it comprehend the absurdity that is a combination or transformation from one liminal state to another. However, it is precisely this deviant logic that comprehends the thinking of the terrorists as they consider the meta-system of the technological infrastructure that shows through the interstices between the various technological systems. In order to see as the terrorists do we need to adopt paradoxical and absurd logics temporarily at least as a means of preempting their strikes at us from our own blind spots.

When we look into that meta-system we can see that it is filled with monsters, as in old maps where monsters lurk at the ends of the earth. There we see black holes, or paradoxical energy sinks, and miracles, or paradoxical energy sources, which go off the scale exponentially and which we assiduously avoid in the boats of our restricted economies when we sail these stormy seas. The combination of blackhole paradoxes and miraculous paradoxes together produce the absurdities that we call singularities. The singularities create catastrophes like those characterized by Rene Thom[27] where the field of the meta-system folds through itself to produce anomalous discontinuous points of transformation in the seascape. All of these effects of the meta-system can take situations completely out of our control. In fact we see the progression toward that in the various kinds of Being which have modalities of being-in-the-world called present-at-hand, ready-to-hand, in-hand and out-of-hand. In other words when we combine the concept of the meta-system with the Diamond or **Vajra** logics we are inadvertently defining the necessity of stepping through the various meta-levels of Being. Normal static entities have Pure Being and our modality in the world when we relate to them is the present-at-hand. When entities become dynamic then we enter Process Being and our modality in the world becomes ready-to-hand. This is the modality where in the Technological system supports us

[26] And which is even considered a hell of endless suicide in their own religion.

[27] See Rene Thom Structural Stability and Morphogenesis an Outline of a General Theory of Models (Perseus Pr 1989)

without our being aware of it. As we know from Zeno contradictions appear at this level. Motion in the world results in contradictions. Interfering paradoxes produce vicious circles. When we take these contradictions to interfere with each other then we have paradox that places us in Hyper Being and our modality of being-in-the-world becomes in-hand. This is the modality where the technological system transforms within our hands. Producing emergent events and genuinely new phenomena like the surprise of the terrorists event on September 11th that changed the world fundamentally in a way recognized by everyone and called war – but a war against not a conventional enemy. World War Three is not like anyone imagined it with Russian and the USA as partners instead of enemies. Finally when we begin to cycle between the twin paradoxes **i** and **j** as fixed points then things get truly out-of-hand as we confront absurdity. This is what Merleau-Ponty called Wild Being. Beyond that is only madness. [28]

We see that clearly when we apply the **Vajra logic,** that allows paradox in the dimensions of truth as well as reality, to the expanded algebraic models of order, and the implicit schemas and categories[29]. This produces a realm in which it is necessary to distinguish right from wrong, i.e. correctness, within in a realm of multifarious variety[30]. In other words, the various combinations of the technological systems within the technological infrastructure as meta-system is almost infinite. Thus all the vulnerabilities are impossible to foresee. What we must do is design the meta-system of the technological infrastructure itself so that the technological systems become orthogonal to each other as much as possible. Thus we will reduce the amount of paradox and absurdity where the various technological systems intersect in ways that can produce unwanted side effects in the hands of those who are prepared to think in ways that are profoundly anti-humanitarian and anti-technological as well, who are in the grips of the irrational and whose thoughts and actions are not merely mad but diabolical as they are controlled by the paradoxicality and absurdity of the deviant logics. Unwanted side-effects obey the higher meta-level of the Diamond or **Vajra** Logics. Ultimately the only way to counter terrorism is to learn to think and reason in this mode as well, i.e. the mode that recognizes the meta-system in the grip of deviant logics. We use our knowledge of the meta-system and the deviant logics to straighten up, render correct, the multifarious overlapping patches of the environment so that the various things in the environment cannot be used against each other as easily to

[28] This paragraph is attempting to describe the following configuration of emergent levels:
doxa
Pure Being
paradox
Process Being
vicious circles
Hyper Being
absurdity
Wild Being
madness

[29] The basis of this Vajra Logic has already been created by August Stern in his books Matrix Logic and Matrix Logic and the Mind. The difference is that Stern has not yet realized that all the aspects of Being need to be considered valences of the logic not just truth and falsehood: i.e. identity/difference, real/illusory and presence/absence. Vajra Logic is merely matrix logic using all four valences. It is a natural extension of Diamond Logic to the next higher meta-level.

[30] Ultimately this is based on fate and arises from sources that in turn arise from a single root. In general we are talking here about the various levels of non-duals at the core of the Western worldview.

produce catastrophe.

Thus it becomes essential, not merely a luxury, to consider the meta-systemic view of our technological infrastructure and consider ways of thinking about them in terms of logics that go beyond our classical logical formal system or restricted economy of thought. Some people talk about the need for thinking out of the box. September 11th has shown us that this is a critical need when considering the meta-system of the technological infrastructure that is the environment of the various technological systems that support our way of life. But this thinking outside of the box as a specific theoretical basis, it is not just random flailing or miraculous inspiration. It combines a meta-systemic view of our systems with an appreciation for the power of deviant paradoxical and absurd logics which in the wrong hands spell disaster. We need to take up these tools ourselves and develop them so that we can counter the terrorist threat within the discipline of Systems Engineering which is now by necessity transformed into Met-systems Engineering.

About the Author

Kent Palmer is a Principal Systems Engineer at a major Aerospace Systems Company. He has a Ph.D. in Sociology concentrating on Philosophy of Science from the London School of Economics and a B.Sc. in Sociology from the University of Kansas. His dissertation on The Structure of Theoretical Systems in Relation to Emergence[31] focused on how new things come into existence within the Western Philosophical and Scientific worldview. He has written extensively on the roots of the Western Worldview in his electronic book The Fragmentation of Being and the Path Beyond the Void[32]. He had at least seventeen years experience[33] in Software Engineering and Systems Engineering disciplines at major aerospace companies based in Orange County CA. He served several years as the chairman of a Software Engineering Process Group and is now engaged in Systems Engineering Process improvement based on EIA 731 and CMMI. He has presented a tutorial on "Advanced Process Architectures[34]" which concerned engineering wide process improvement including both software and systems engineering. Besides process experience, he has recently been a software team lead on a Satellite Payload project and a systems engineer on a Satellite Ground System project. He has also engaged in independent research in Systems Theory which has resulted in a book of working papers called Reflexive Autopoietic Systems Theory[35]. A new introduction to this work now exists called *Reflexive Autopoietic Dissipative Special Systems Theory*[36]. He has given a tutorial[37] on Meta-systems engineering to the INCOSE Principles working group. He has written a series on *Software Engineering Foundations* which are contained in the book Wild Software Meta-systems[38]. He now teaches a course in "Software Requirements and Design Methodologies" at the University California Irvine Extension.

[31] http://dialog.net:85/homepage/disab.html You man also try http://dialog.net or http://think.net for any of the web related material.

[32] http://dialog.net:85/homepage/fbpath.htm
[33] http://dialog.net:85/homepage/resume.html
[34] http://dialog.net:85/homepage/advanced.htm
[35] http://dialog.net:85/homepage/refauto2.htm
[36] http://dialog.net:85/homepage/autopoiesis.html
[37] http://dialog.net:85/homepage/incosewg/index.htm
[38] http://dialog.net:85/homepage/wsms.htm