Meta-systems Engineering

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Version 0.3

Three Papers

- Meta-systems Engineering (INCOSE2000)
- Anti-terror Meta-systems Engineering
- Vajra Logic and Mathematical Meta-models for Meta-systems Engineering

Précis

- Basic purpose of this talk is to persuade the practitioners of the Systems Engineering discipline to look beyond Systems Theory as the source of schemas for understanding phenomena and designing artifacts
- In the current discipline, three schemas are emphasized
- This should be expanded ultimately to at least ten different schemas
- But here we will focus on a consideration of at least one more schema – the meta-system
- This schema has profound implications for the transformation of the this discipline into Meta-systems Engineering.

system of systems

Meta-system

system

Meta-system

sub-system

The same schema of a "system"
is projected at various levels in a hierarchy

This implies that the "system" schema is all we need to understand things and states of affairs

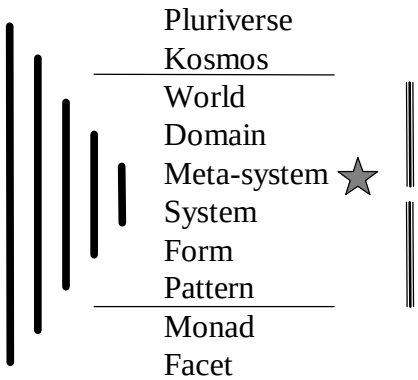
Formal Structural System

System Schema -- description	wholes and parts universal algebra	systemism
Form Schema -- proof	geometry logic	formalism
Pattern Schema -- explanation	reductionism (atomic theory in relation to chemistry)	structuralism

Current science emphasizes three basic schemas

Schemas

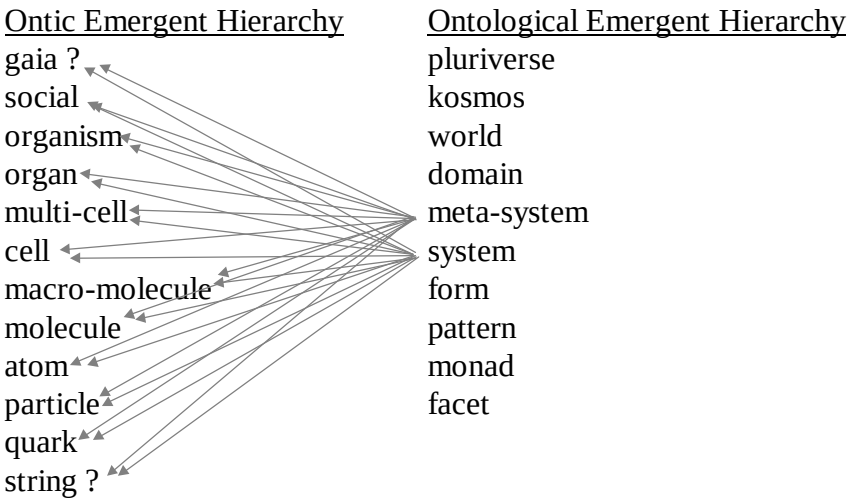
example ontological hierarchy



'Domain World Meta-system' ?

Formal Structural System

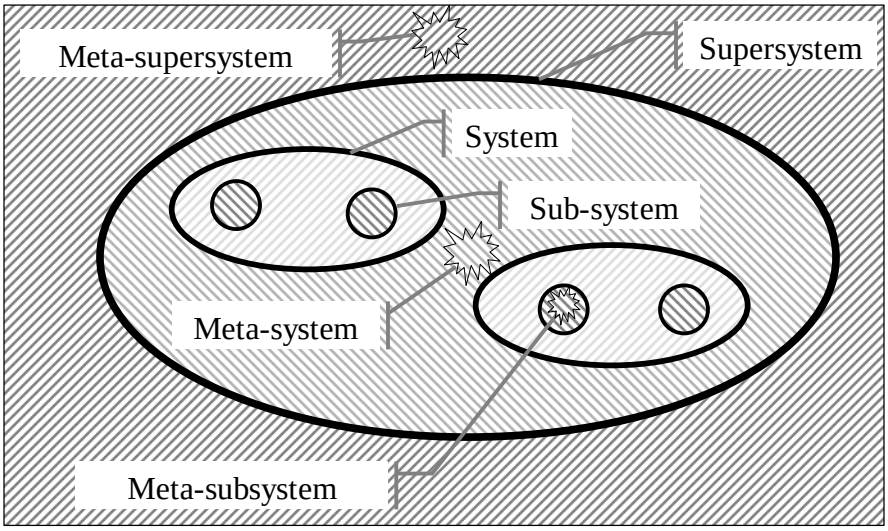
Emergent Hierarchies



Dual Schemas

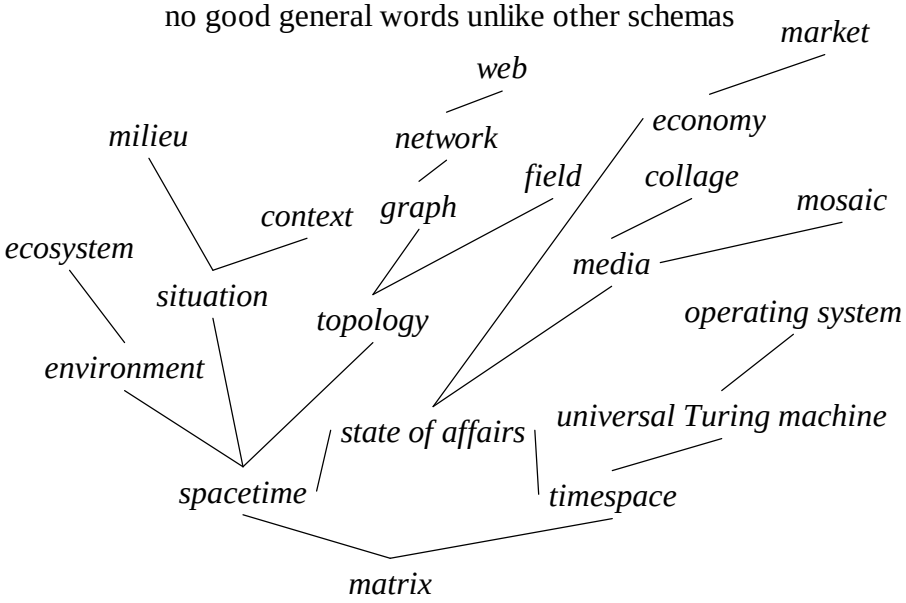
System *description*	**Meta-system** *indication*
Gestalt	Proto-gestalt
Turing Machine	Universal Turing Machine
Restricted Economy	General Economy
Application	"Operating System"

Meta-systems exist between system hierarchy levels

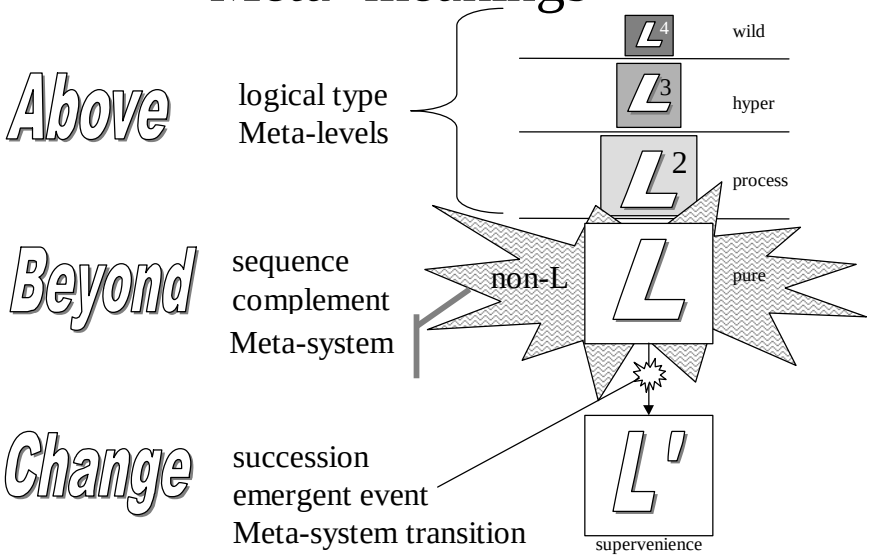


Types of Meta-systems

no good general words unlike other schemas



‘Meta’ meanings

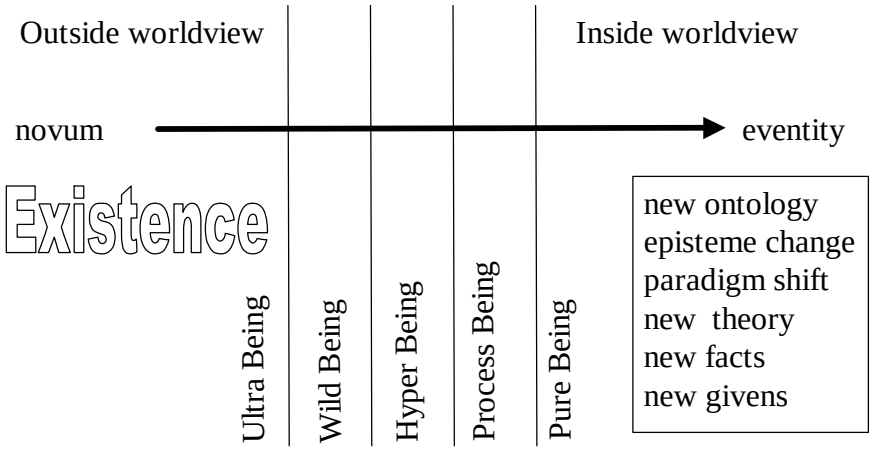


Kinds of Being

Ultra Being	no hand	nonattachment	indeterminate discontinuous	model theory
Wild Being	out-of-hand	encompass	propensity chaotic	category theory
Hyper Being	in-hand	bear	possibility fuzzy	group theory
Process Being	ready-to-hand	grasp	probability stochastic	algebra
Pure Being	present-at-hand	point	determinant continuous	geometry
being, entity, thing				arithmetic

Emergent Event

Emergent event must traverse all four kinds of Being to be genuine

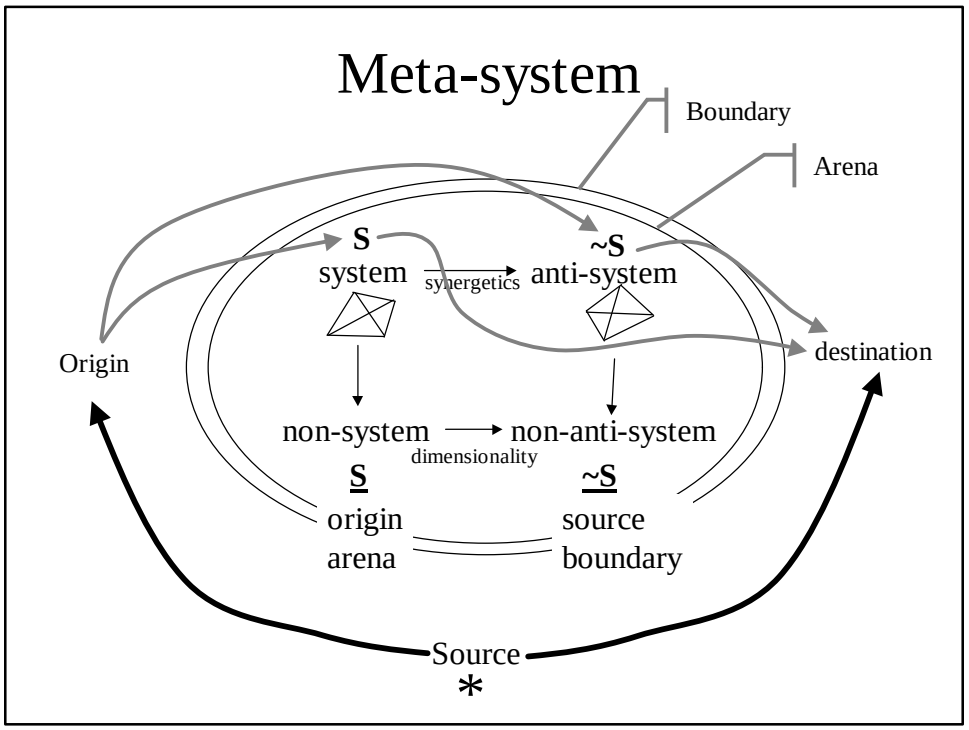


System Schema

ontic	layers of worldview			ontology	
specimen	exception	property	condition	System	schema
speech	pun	phoneme	grammar	language	example
play	case	piece	rule	game	example
Thing-in-itself existent 'magma'	contrary	filter	norm	Projection	
ultra	wild	hyper	process	pure	

Meta-system schema

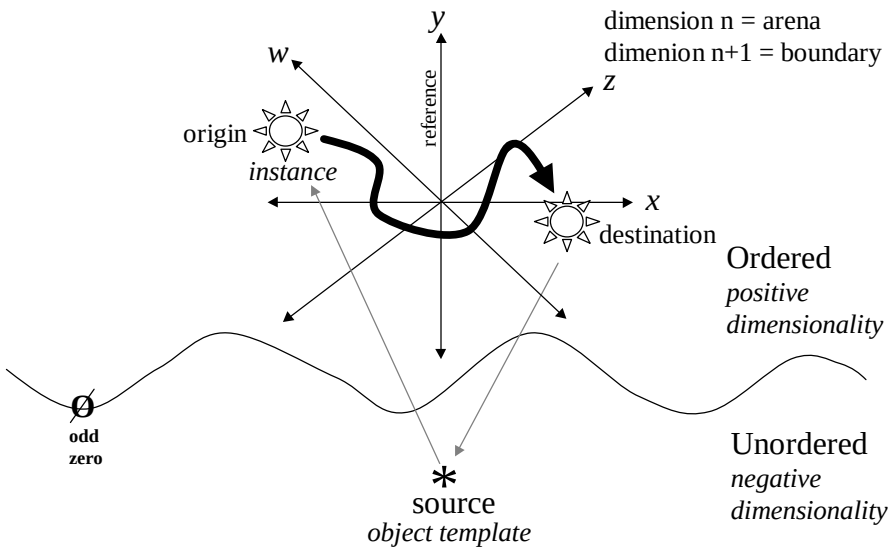
ontic	layers of worldview			ontology	
locus	catastrophe	resources	dualities	Meta-system	schema
replication	low ratings	distribution	creator audience	media	example
node	hot/soc	source/sink	node/link	network	example
organism	extinction	food, water, air	plant/animal	environment ecosystem	example
potential	oscillation	generator	positive/ negative	field (magnetic)	example
transaction	crash	production	buy/sell	market	example
thing-in-itself	contrary	filter	norm	Projection	
ultra	wild	hyper	process	pure	



Aspects of Meta-system

Boundary	**Source**
horizon	object template outside spacetime
Origin	**Arena**
Entry point in spacetime gatekeeper	Media for interplay between system and anti-system

Geometry Example



Highway example

Boundary Sides of road	**Source** entry from streets
Origin and destination on ramp and off ramp	**Arena** lanes

System = automobile
Meta-system = highways

Overpass structure at cloverleaf grade separation of U. S. 101 and Mission Valley highways in San Diego

Bifurcation

Boundary	**Source**
Origin	**Arena**

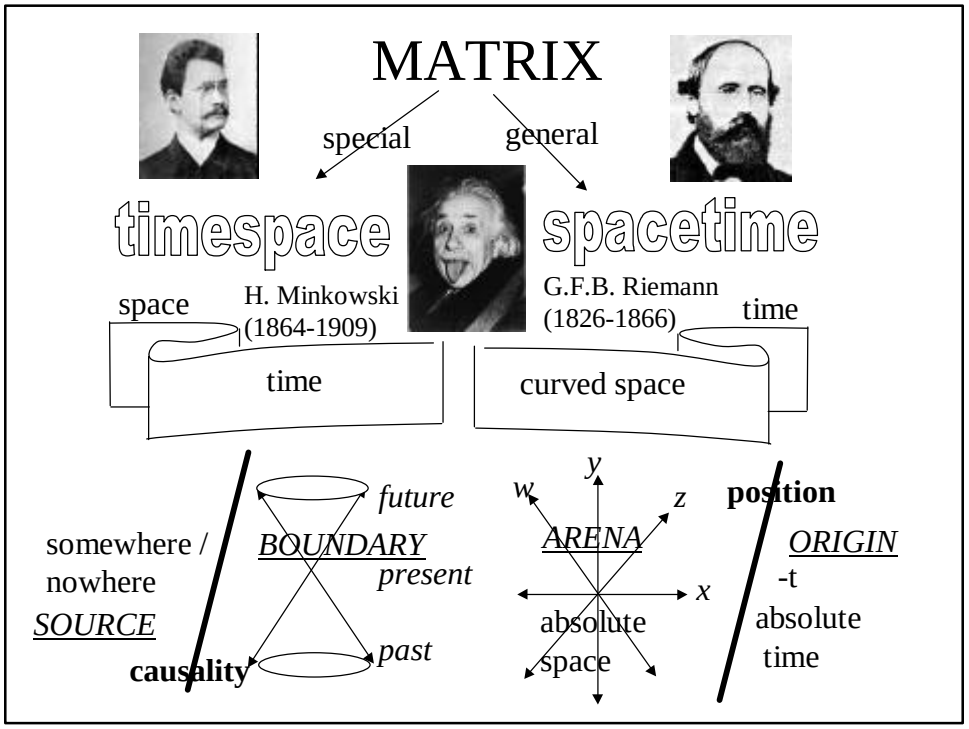
positive feedback miracle / blackhole	negative dimensional ramification
singularity catastrophe	positive dimensional ramification

Highway example

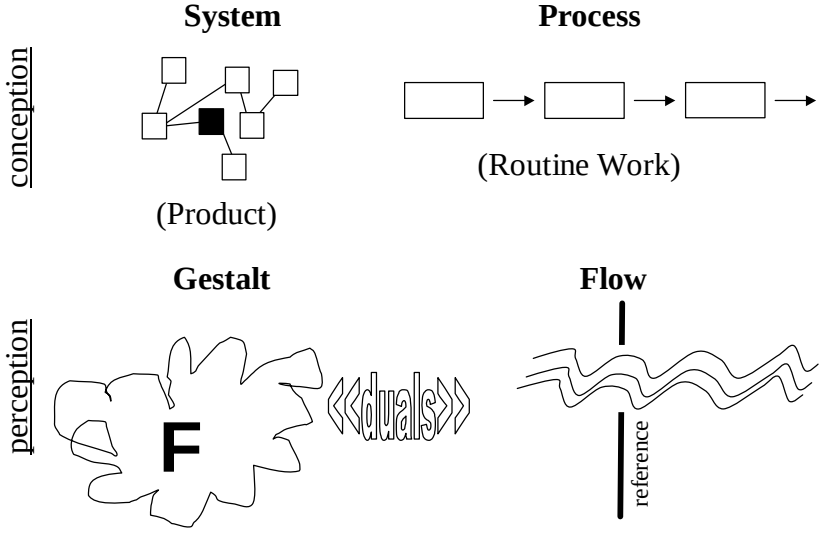
Clover-leaf
• crossing without stopping
• Non-stop driving on Freeways

Highway example

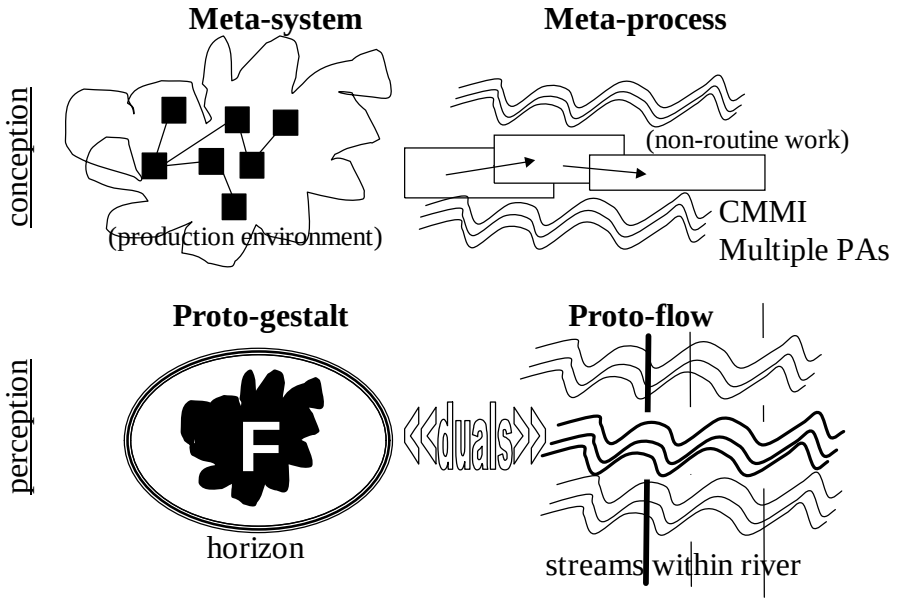
Miracle / Blackhole	**Negative Ramification**
efficient and effective transport / endless energy use increased safety /environmental impact brings business / proliferation of highways tourism / homogenization of landscape suburbs / urban sprawl	entry from streets showroom – gas station factory - refinery raw materials - oil wells
Singularity / Catastrophe	**Positive Ramification**
lane divider road divider no oil car breakdowns accidents	connection between different types of transport air/car/truck/sea etc connection between different parts of the economy


MATRIX
special
general
timespace
spacetime
H. Minkowski
(1864-1909)
G.F.B. Riemann
(1826-1866)
space
time
time
curved space
somewhere /
nowhere
SOURCE
causality
future
BOUNDARY
present
past
y
w
z
x
ARENA
absolute
space
position
ORIGIN
-t
absolute
time

Foreground


System
Process
conception
(Product)
(Routine Work)
Gestalt
Flow
perception
F
«duals»
reference

Background



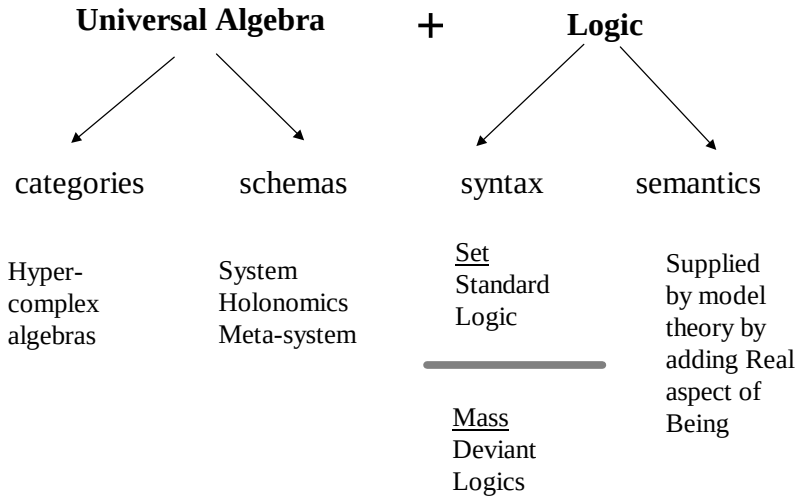
Count verses Non-count approaches

SET *things* essence collection of difference unity	**MASS** *stuff* group action fusion of identity totality
Syllogistic logic Excluded middle Boolean logic Attribute => Particular Universal	**Pervasion logic** Included middle Brownian Laws of Form Mass => Instance Boundary

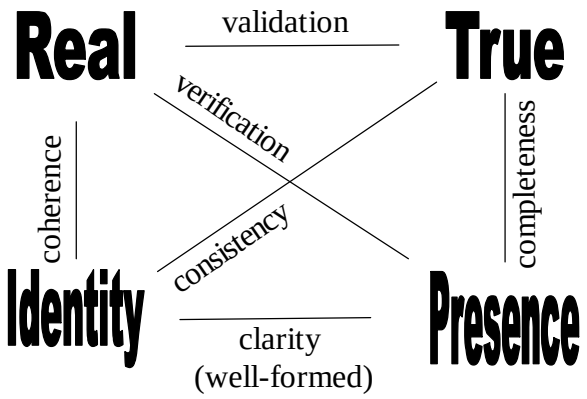
Strange Logics

- Mass Pervasion Logic (India, China)
- Laws of Form (Brown, Bricken)
- Diamond Logic (Hellerstein)
- Vajra Logic (includes all aspects of Being)
- Matrix Logic (Stern)

Model Theory



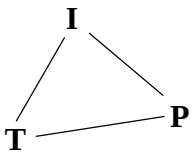
Aspects of Being and Fundamental Properties



Model Theory

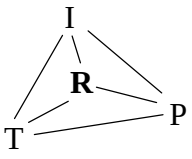
- **Syntax**
- Consistency
- Completeness

- Clarity



- **Semantics**
- Validation = Model
- Coherence = Theory

- Verification = Speculation



Note: addition of reality generates meaning!

Meta-model Theory

Universal algebra	+	Representations Interpretations	+	Logical Syntax	+	Meaningful Semantics
Hyper-Complex Algebras	+	**Schemas**	+	**Deviant Logics**	+	**Rational Grammar**

Meta-model Theory

Real algebra	System	Boolean Logic	Normal Grammar
Complex algebra	Dissipative Special System (Prigogine)	Boundary Logic (Briklin, Brown)	Models
Quaternion algebra	Autopoietic Special System (Varela & Maturana)	Diamond Logic (Hellerstein)	Theories
Octonion algebra	Reflexive Special System (O'Malley, Sandywell	Vajra Logic	Speculations
Sedenion algebra	Meta-System (Bataile, Plotnitsky)	Matrix Logic (Stern)	Discourse

Anti-terror Meta-systems Engineering

- Need to look at meta-systems not just systems
- Meta-systems need to be explicitly designed along with other expansive schemas like domains and worlds
- Need to use Deviant Logics not just standard logic
- **Terrorists exemplify reasoning by deviant logics not just bad motives**
- **We need to preempt them by using deviant logics ourselves first**
- **Deviant logics are useful for finding unintended side effects within the meta-system**