

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

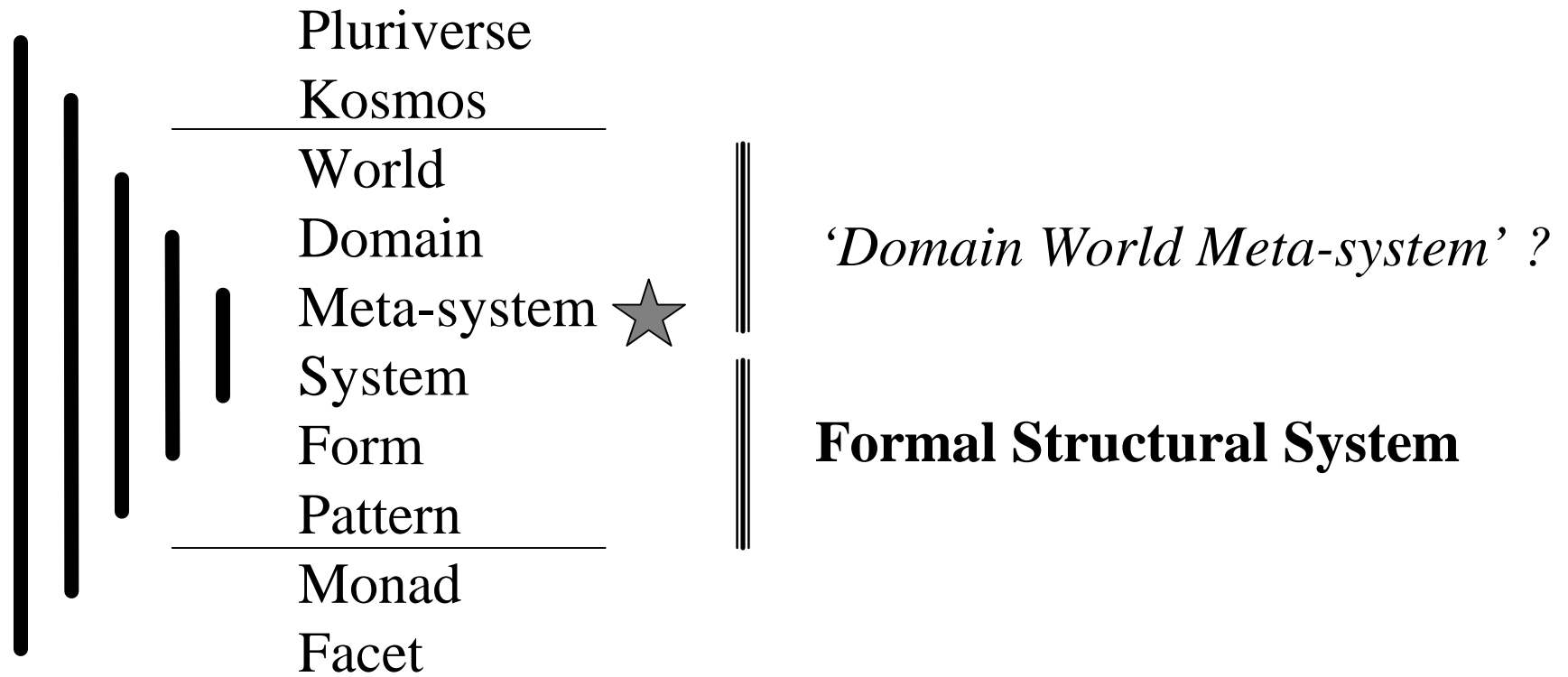
Formal Structural System

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



Emergent Hierarchies

Ontic Emergent Hierarchy

gaia ?

social

organism

organ

multi-cell

cell

macro-molecule

molecule

atom

particle

quark

string ?

Ontological Emergent Hierarchy

pluriverse

kosmos

world

domain

meta-system

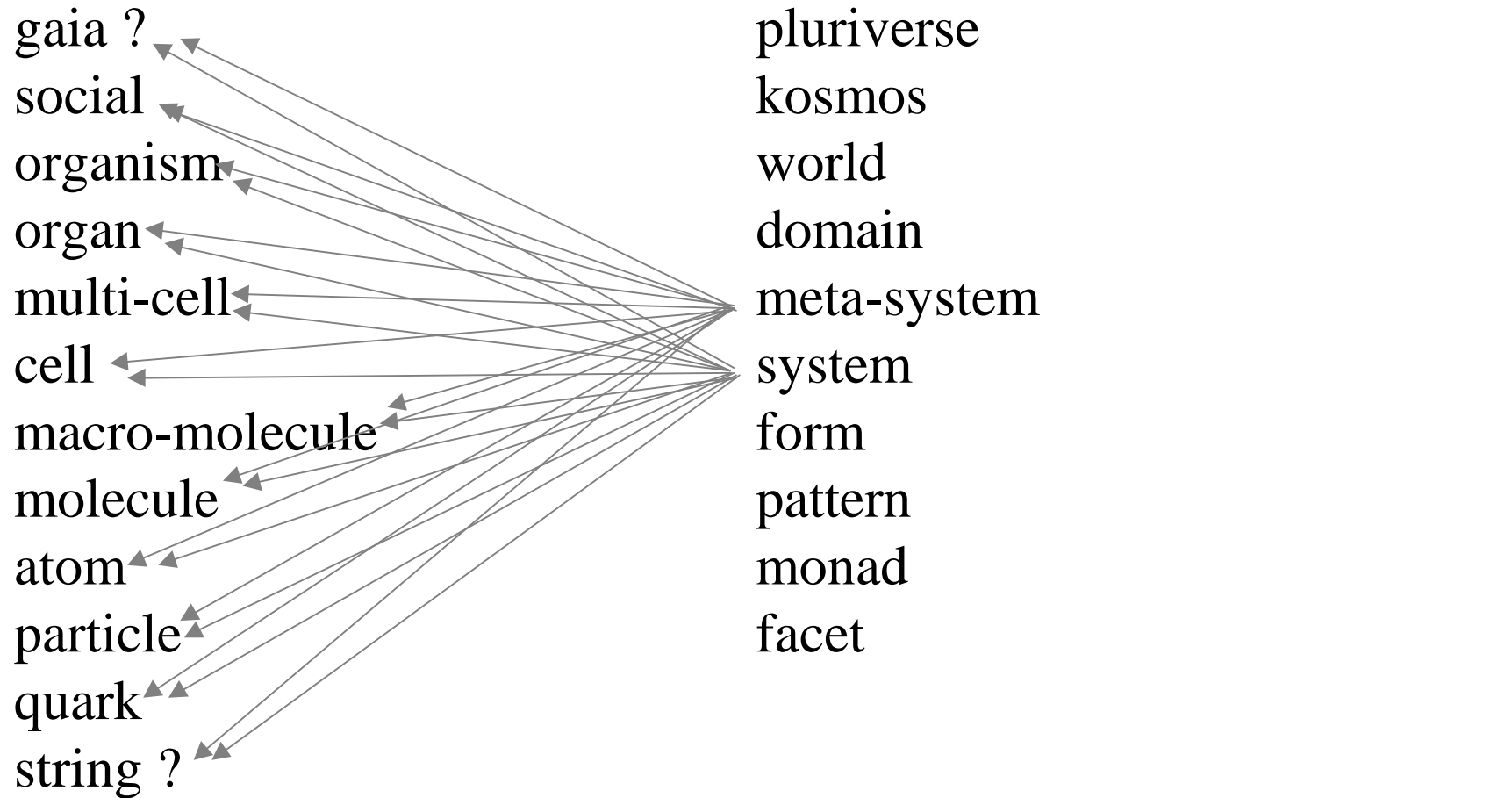
system

form

pattern

monad

facet



Dual Schemas

System
description

Meta-system
indication

Gestalt

Proto-gestalt

Turing Machine

Universal Turing Machine

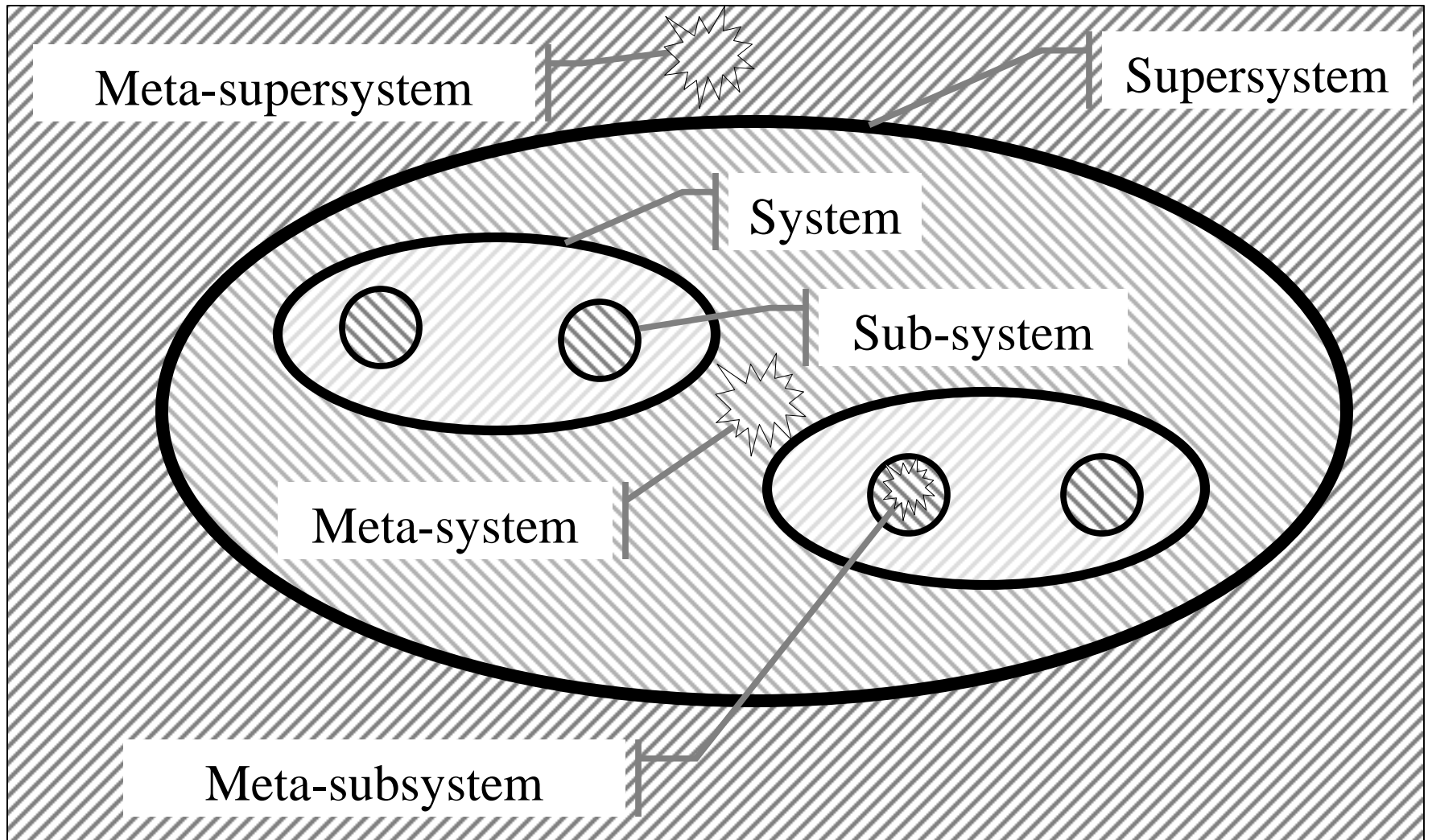
Restricted Economy

General Economy

Application

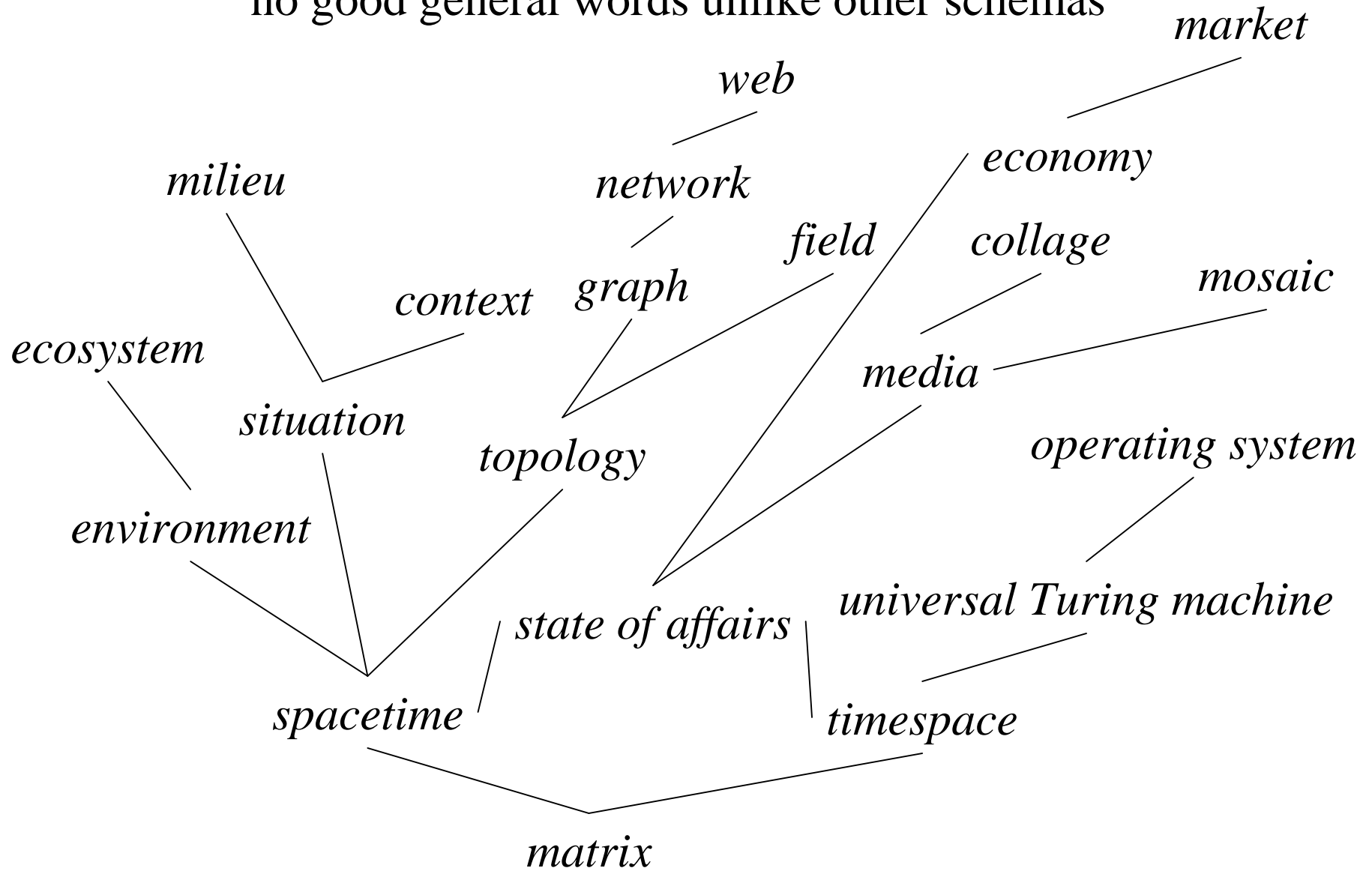
“Operating System”

Meta-systems exist between system hierarchy levels



Types of Meta-systems

no good general words unlike other schemas



'Meta' meanings

Above

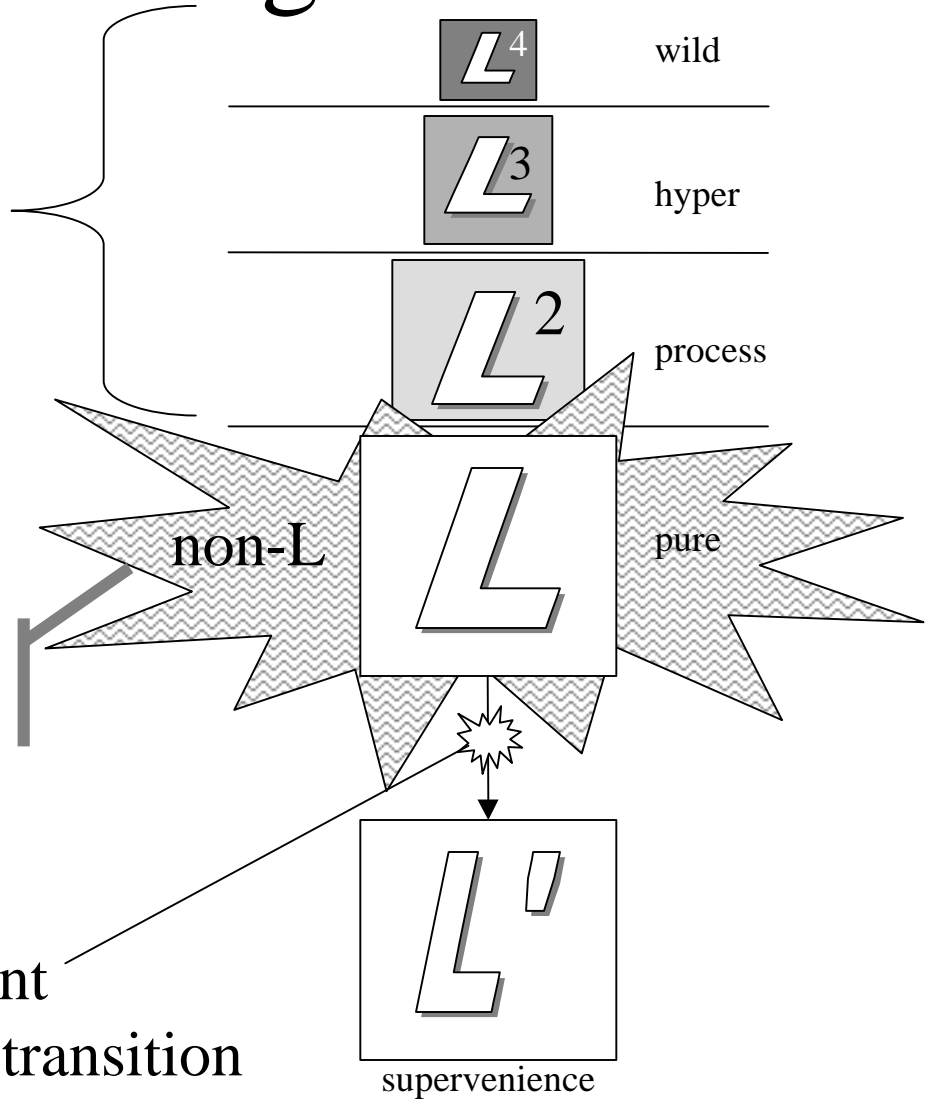
logical type
Meta-levels

Beyond

sequence
complement
Meta-system

Change

succession
emergent event
Meta-system transition

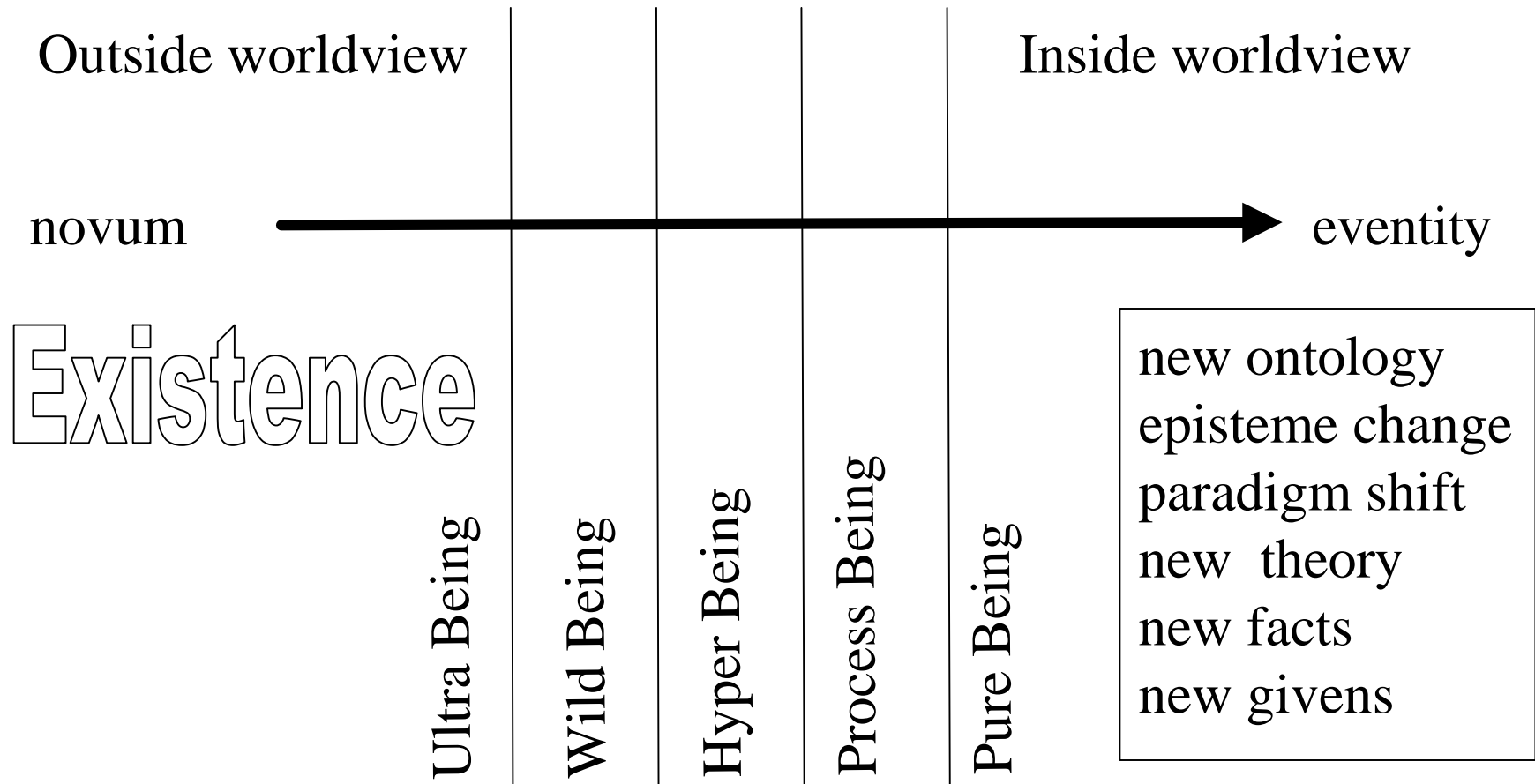


Kinds of Being

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

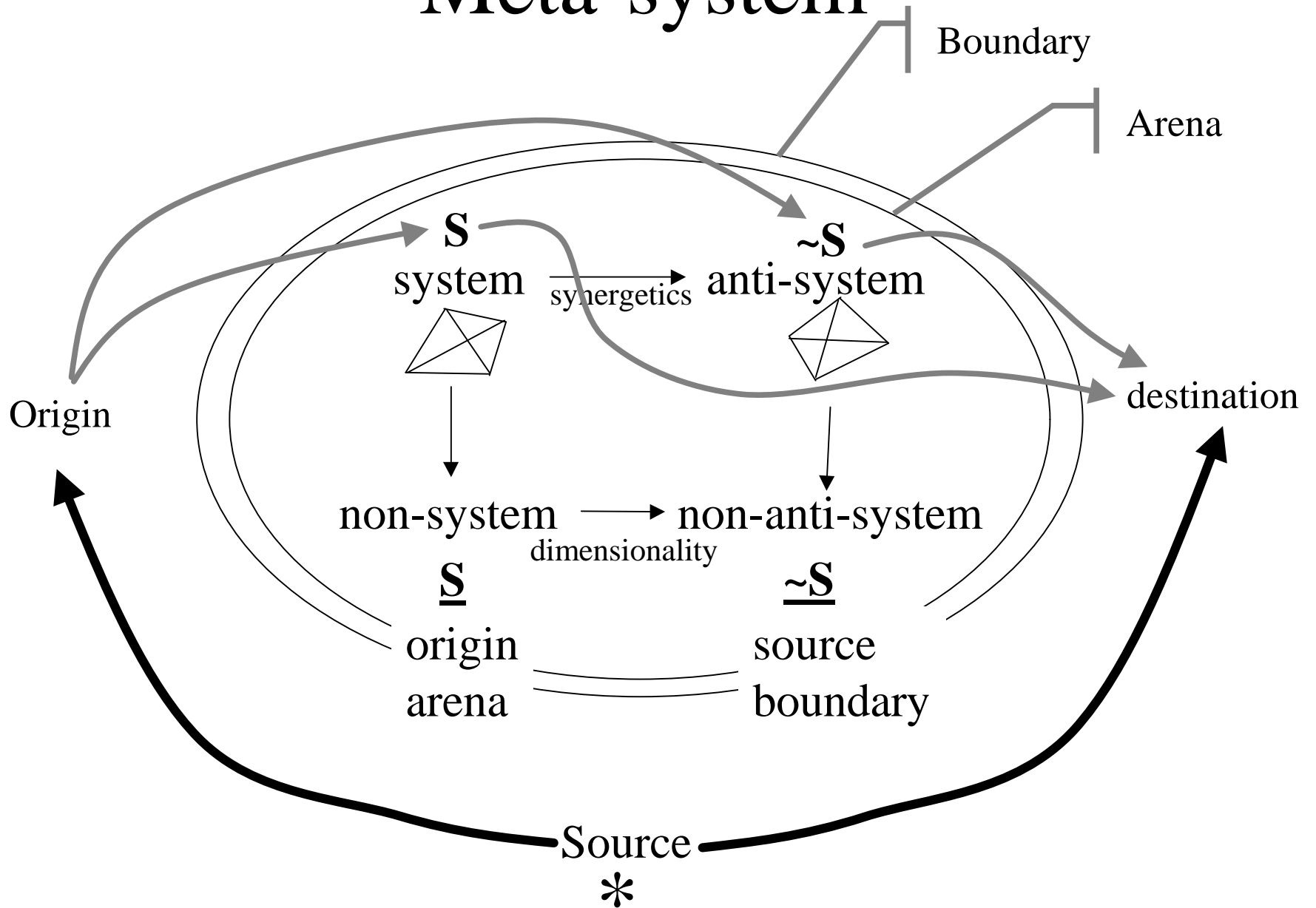
ontic	layers of worldview			ontology	
specimen	exception	property	condition	System	schema
speech	pun	phoneme	grammar	language	example
play	case	piece	rule	game	example
Thing-in-itself existent 'magma'	contrary	filter	norm	Projection	
ultra	wild	hyper	process	pure	

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	



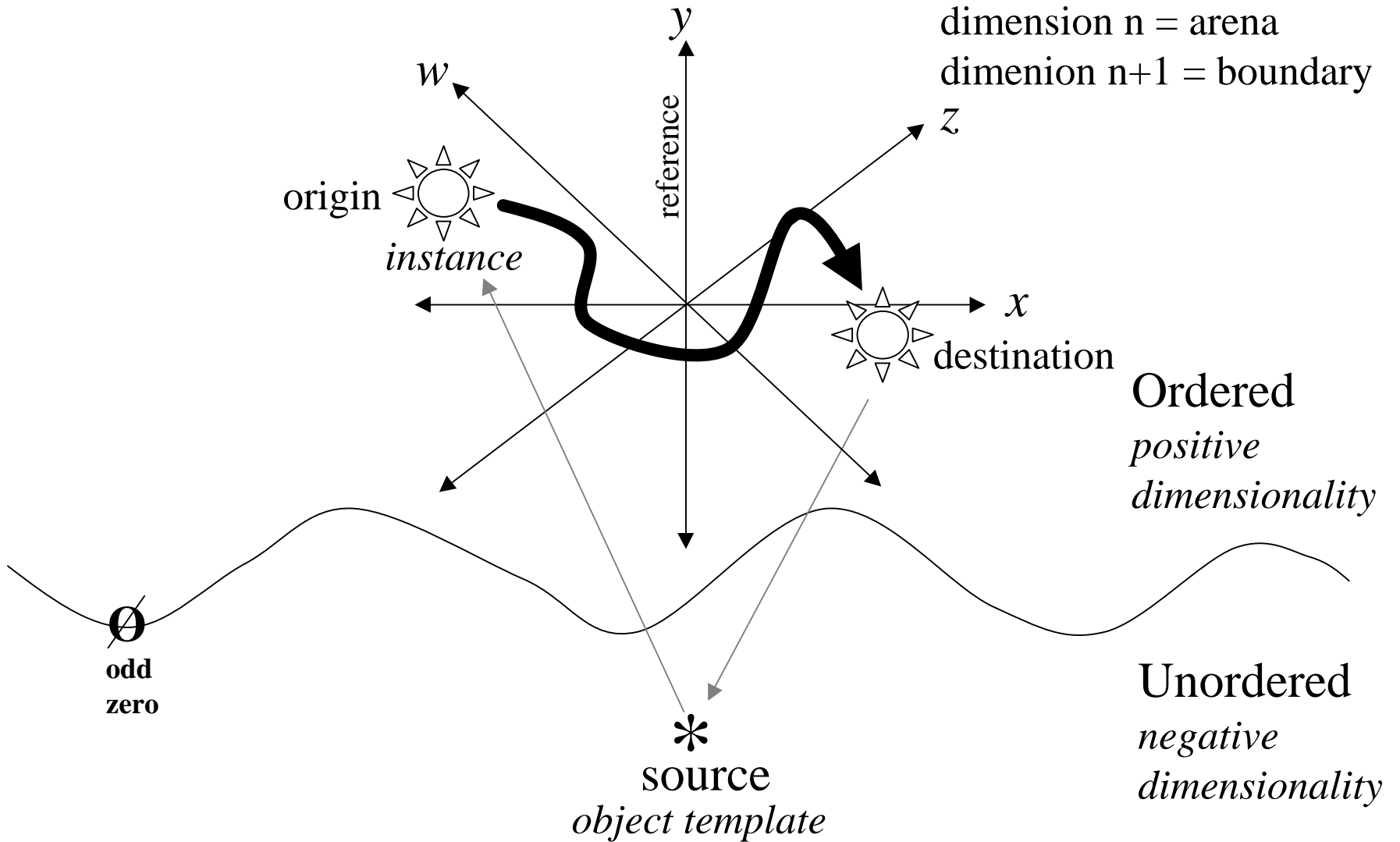
Meta-system



Aspects of Meta-system

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

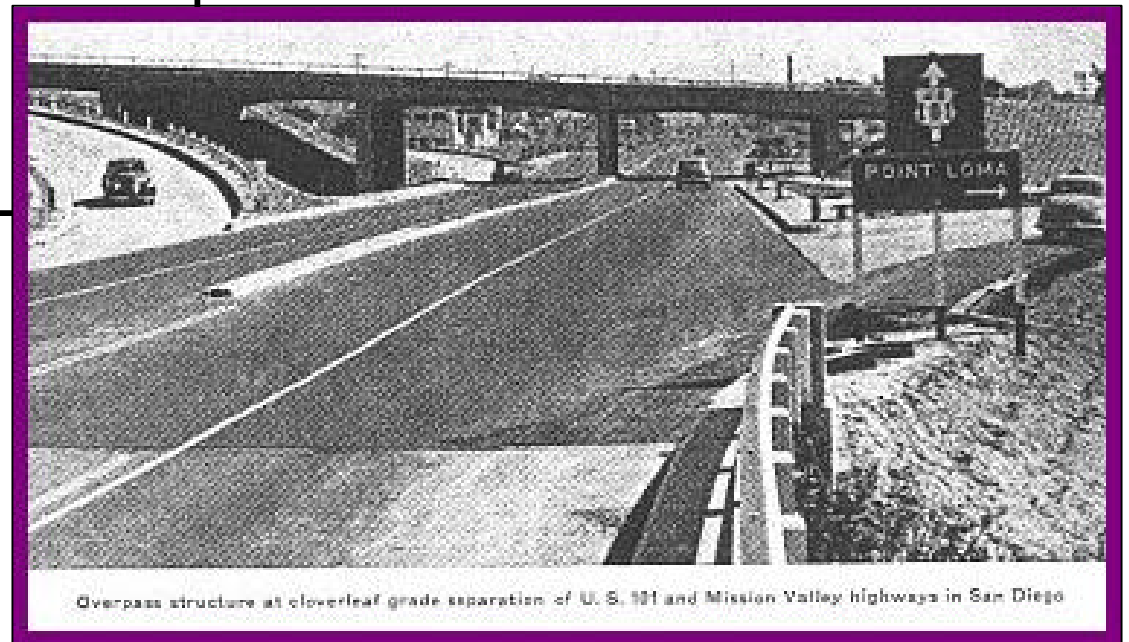
Geometry Example



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



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

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

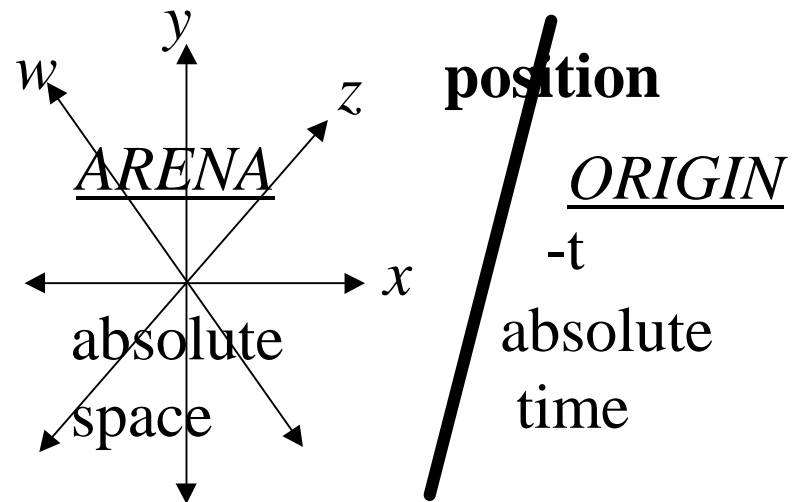
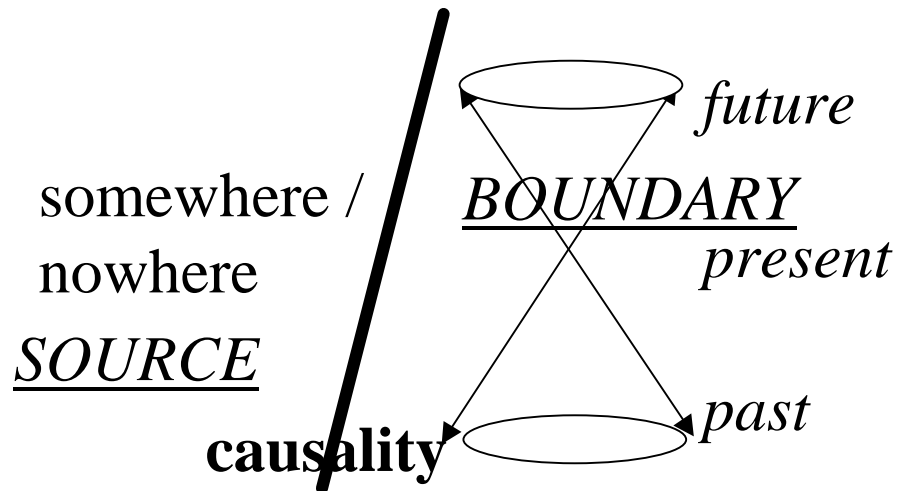
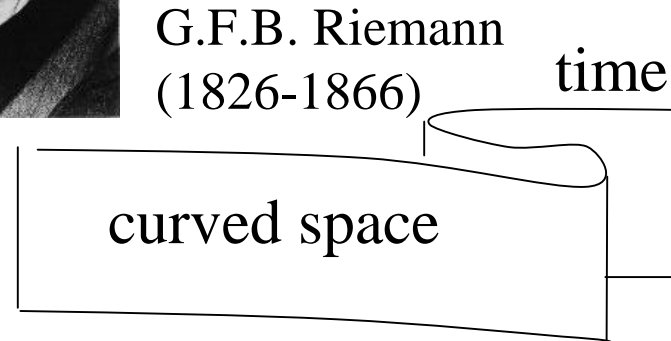
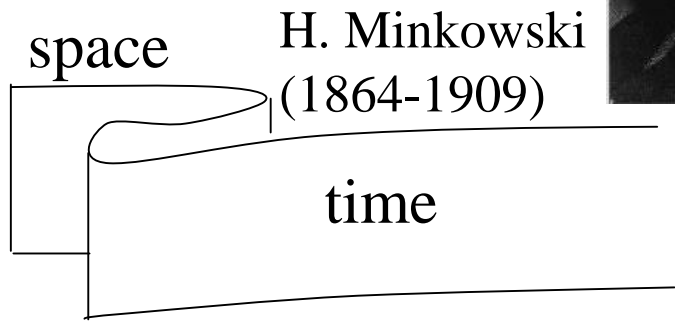
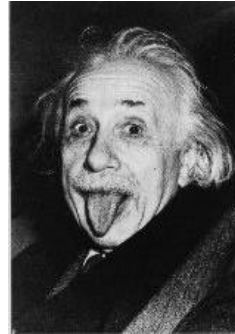


MATRIX



timespace

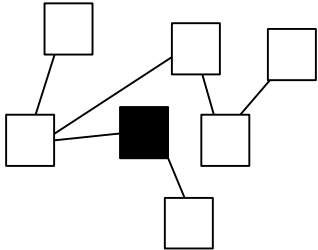
spacetime



Foreground

conception

System



(Product)

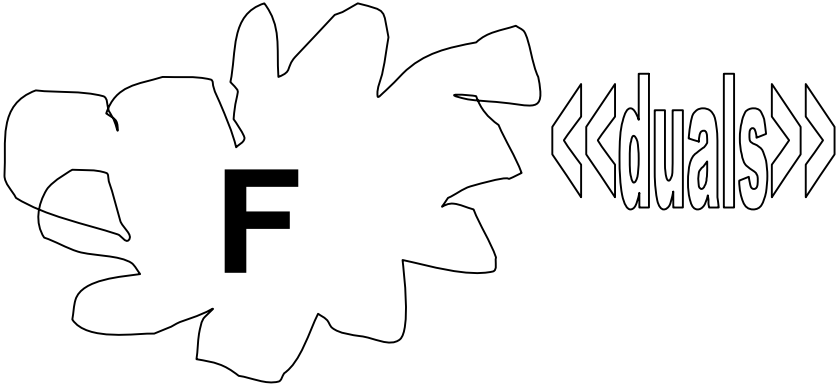
Process



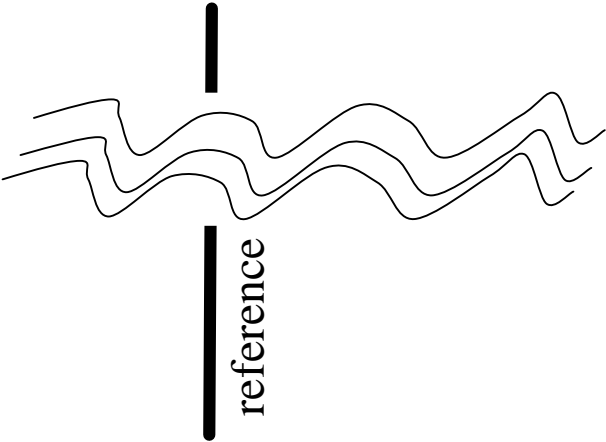
(Routine Work)

perception

Gestalt



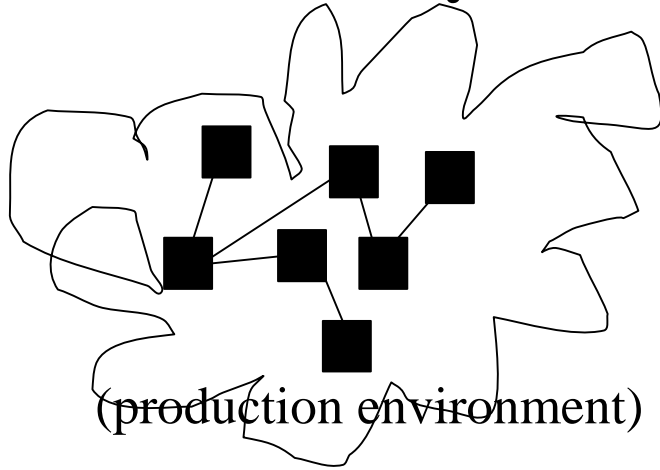
Flow



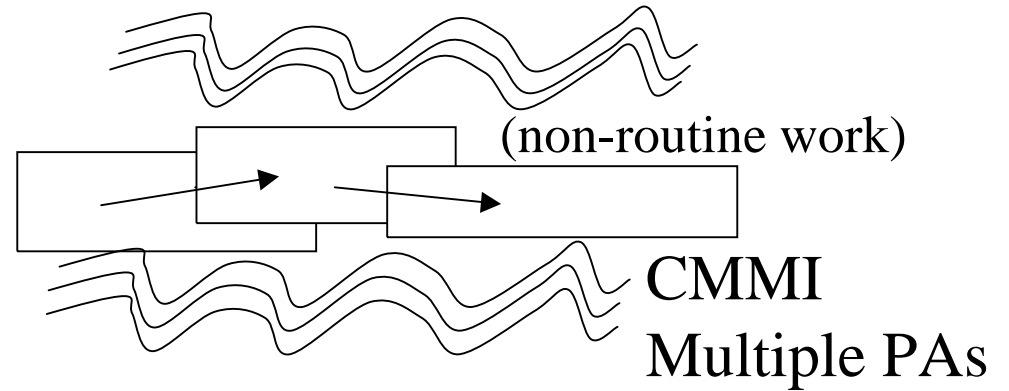
Background

conception

Meta-system



Meta-process

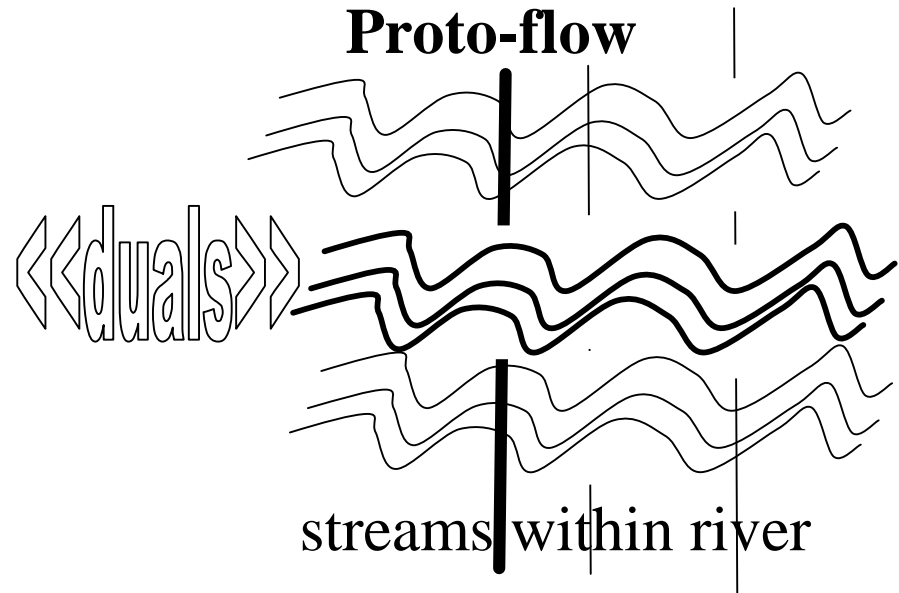


perception

Proto-gestalt



Proto-flow



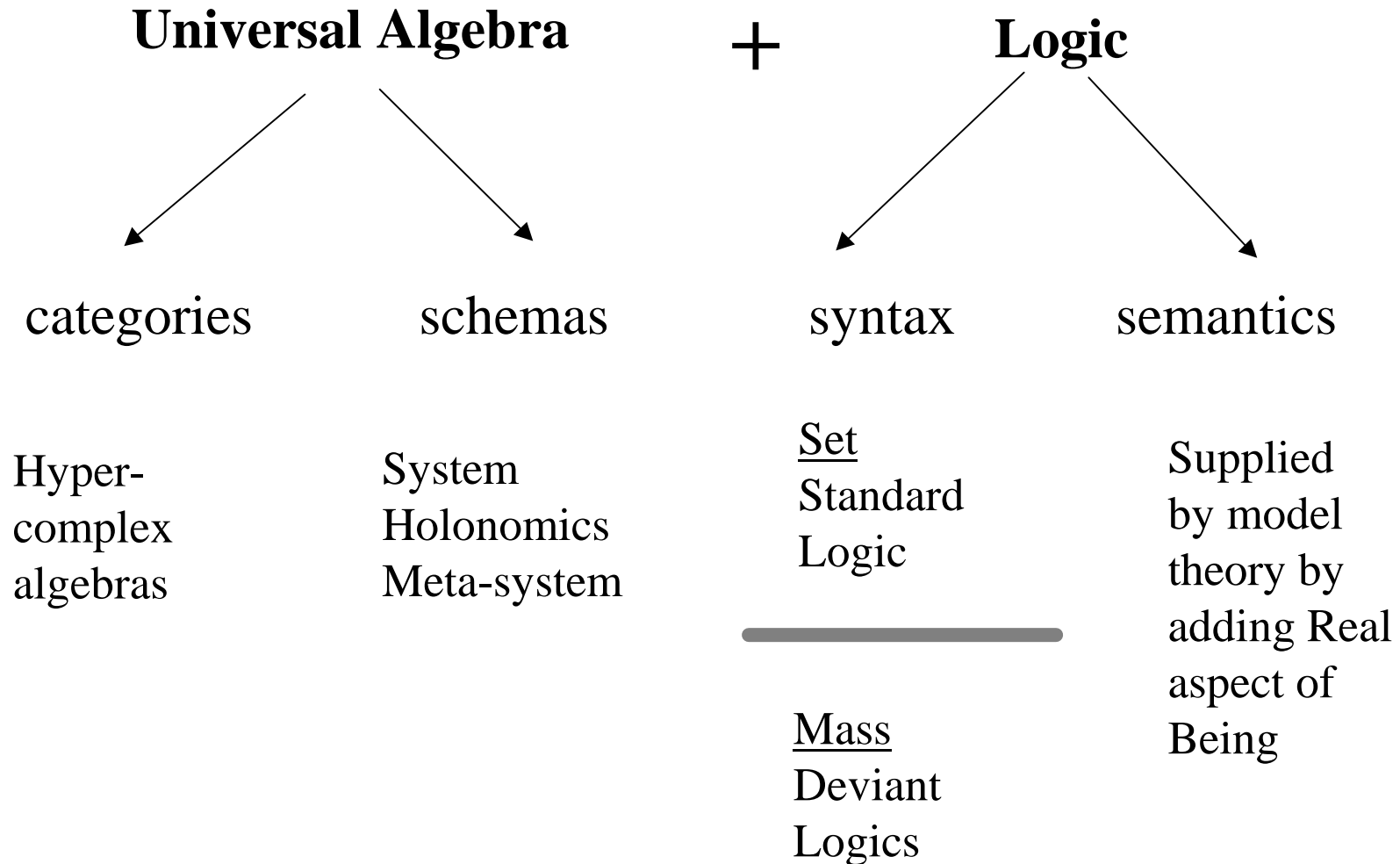
Count verses Non-count approaches

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

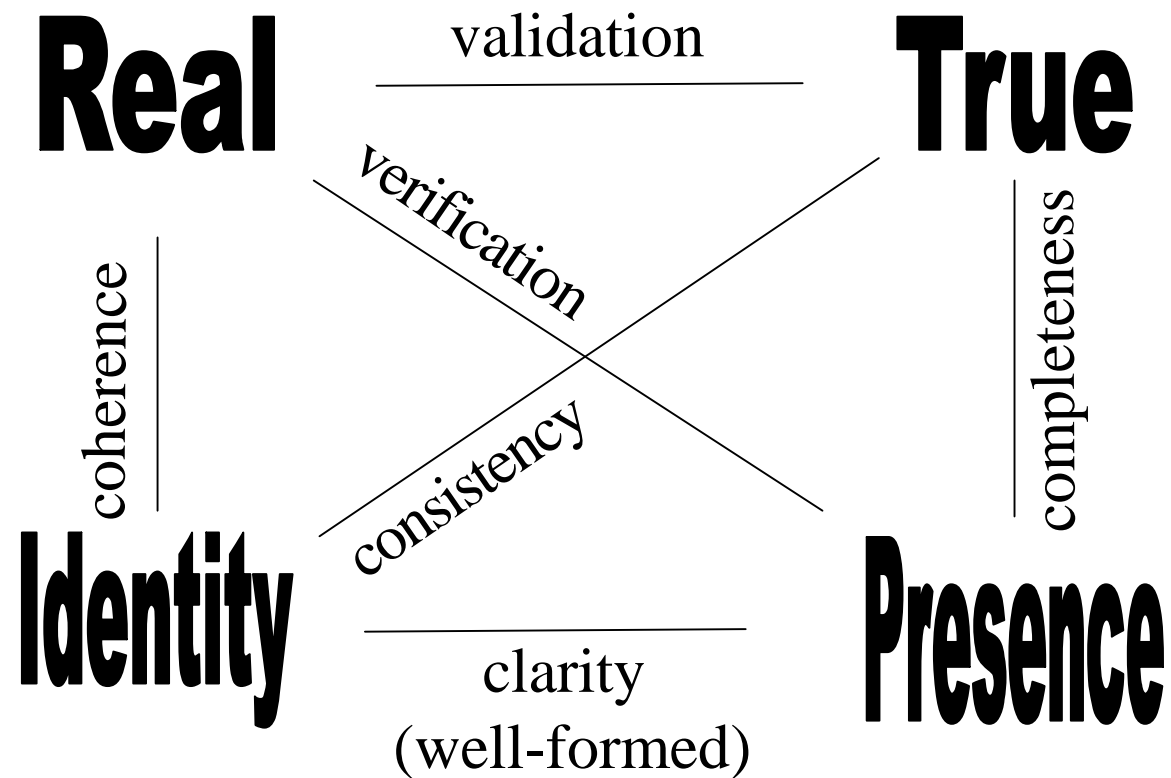
Strange Logics

- 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



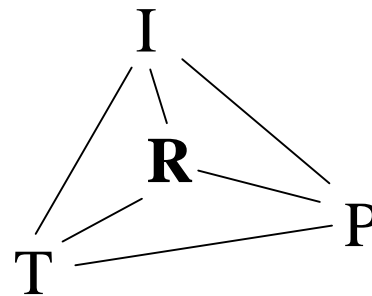
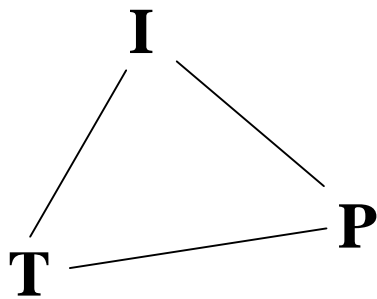
Aspects of Being and Fundamental Properties



Model Theory

- **Syntax**
 - Consistency
 - Completeness
 - **Semantics**
 - Validation = Model
 - Coherence = Theory
-

- Clarity
- Verification = Speculation



Note:
addition
of reality
generates
meaning!

Meta-model Theory

Universal algebra + Representations + Logical Syntax + Meaningful Semantics
Interpretations

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**