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An Overview of Elements and Relations: Aspects of a Scientific Metaphysics

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An overview of Elements and Relations: Aspects of a Scientific Metaphysics

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International Society for the Systems Sciences

On-line mini-symposium, Nov 10, 2023

Abstract

- In this mini-symposium, I'll give an overview of my book, *Elements and Relations: Aspects of a Scientific Metaphysics*, recently published by Springer, part of IFSR International Series in Systems Science & Systems Engineering, initiated by George Klir, current editor George Mobus.
- The book is a synthesis of many aspects of systems field. I'll summarize a few key ideas of the book and explain its complex structure.
- I've been a faculty member in the Systems Science program at Portland State University since 1976, so this book is the product of many years of working with systems ideas and methods.

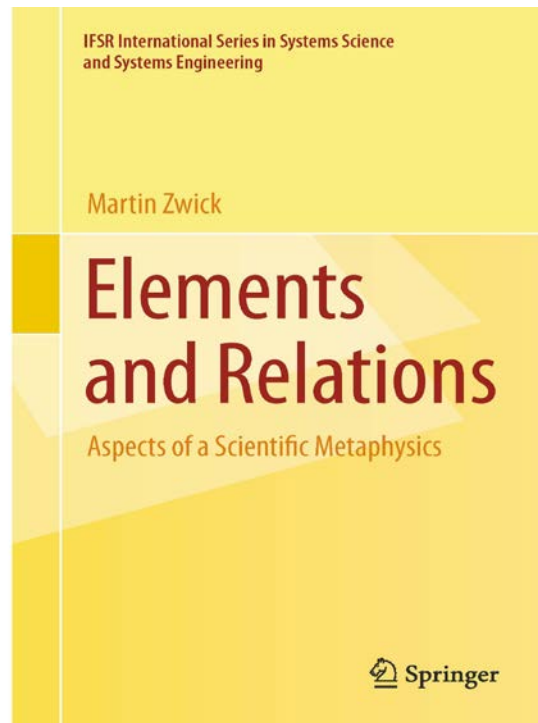
- **The idea of “system”:** structure/function (+ history)
- **The systems field:** systems theory, systems analysis
- **Systems theory:** “exact & scientific metaphysics”
- **Three parts & purposes of book**
- **Essay:** unites *structure* & *function* (synchronics, diachronics)
- **Commentary:** about *function* of systems theory
- **Notes:** about *structure* of systems theory (synchronics, diachronics)
- **Appendix:** auto-critique

Elements and Relations

Aspects of a Scientific Metaphysics

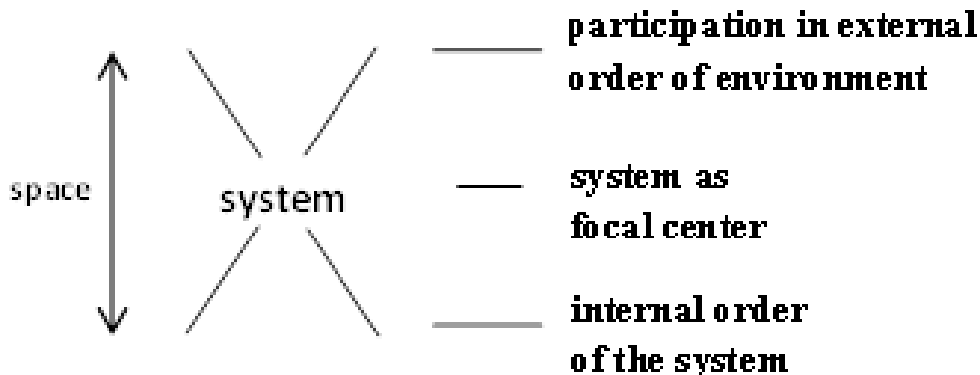
Hardcover & PDF available at Springer site

<https://link.springer.com/book/10.1007/978-3-030-99403-7>

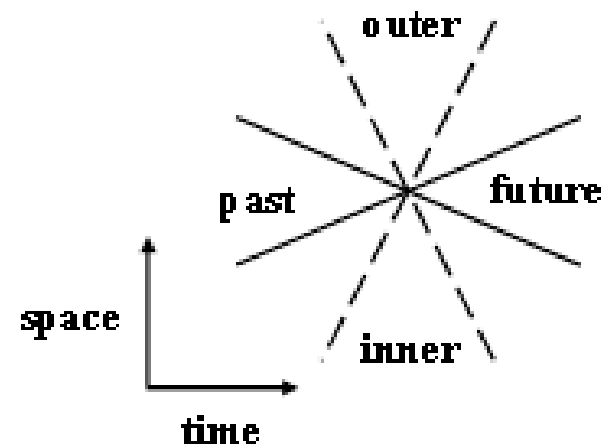


The idea of “system”

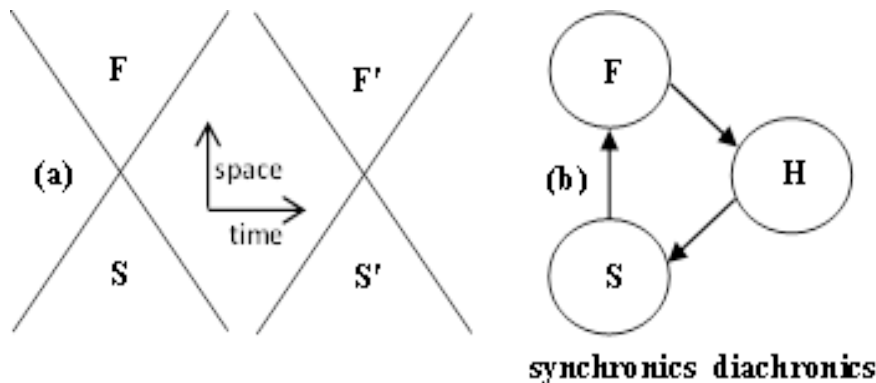
System as center



Spatio-temporal tetrad (object- event)



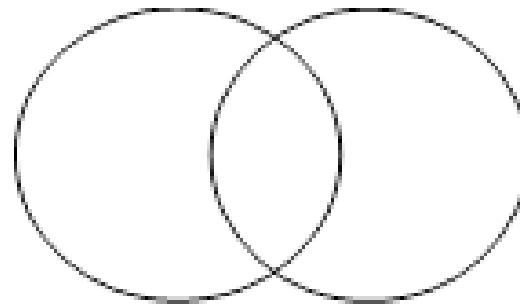
Structure, Function, History



The systems field

Systems theory and systems analysis

(Sizes of circles & of their overlap are arbitrary.)



SYSTEMS THEORY

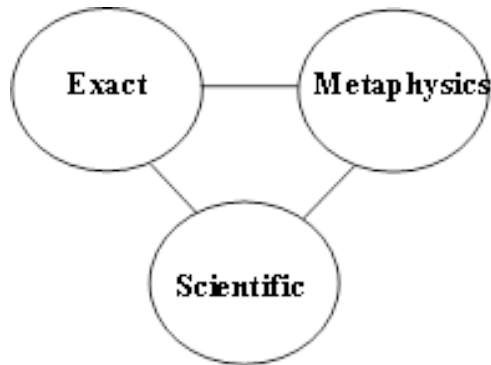
transdisciplinary theoretical
synthesis; exact and
scientific metaphysics

SYSTEMS ANALYSIS

real-world problem solving

Systems theory

- Exact and scientific metaphysics: ESM (Bunge)



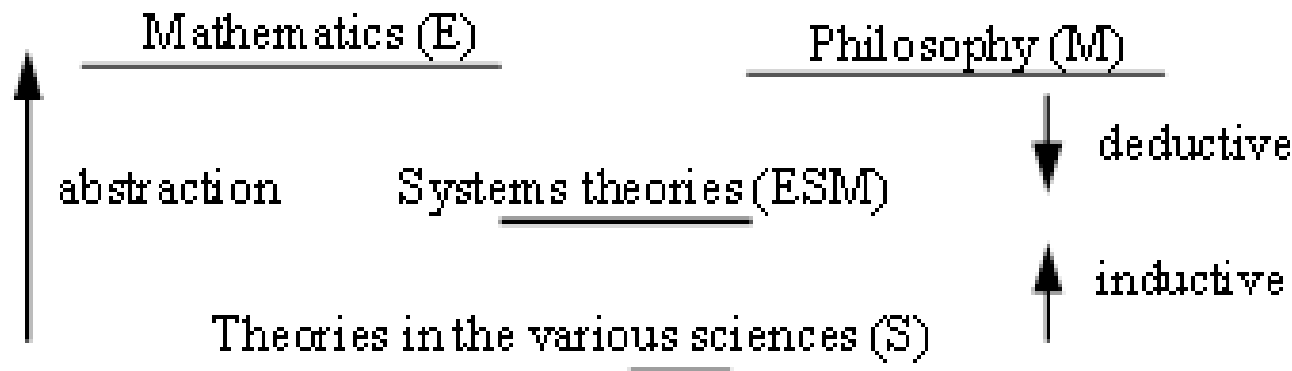
Metaphysics = general ideas, widely applicable

Exact = mathematical (at least ideally or ultimately)

Scientific = drawing on & contributing to scientific theories

There is no *singular system theory*; it's a *project*

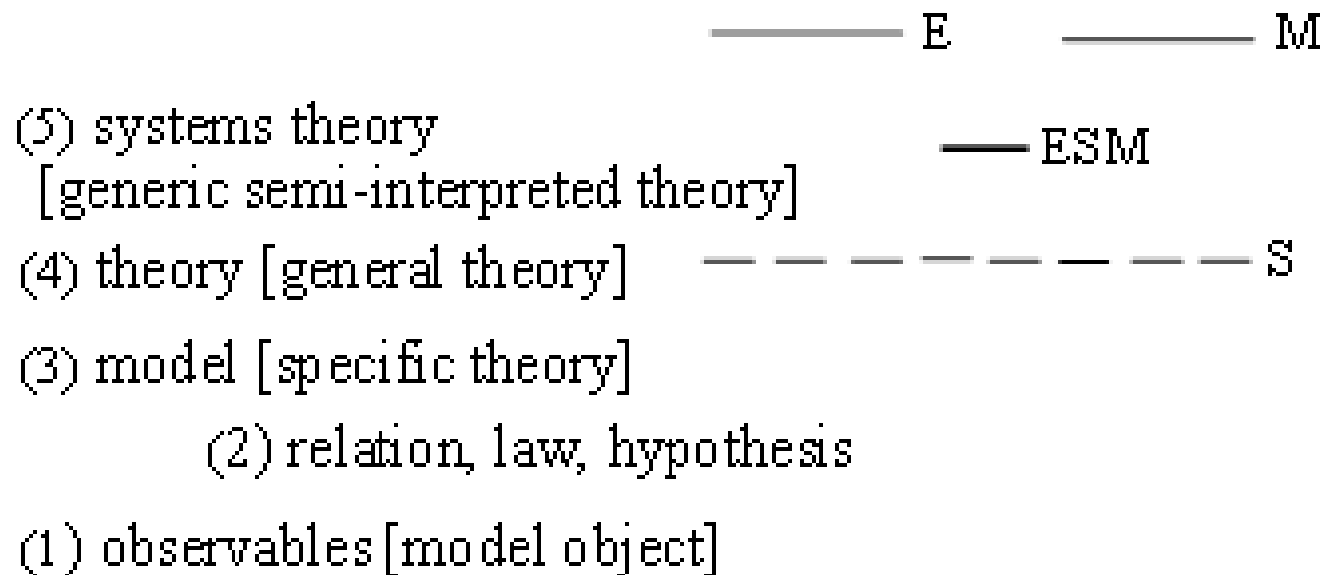
- Between math/philosophy & scientific theories (von B, Ashby)



Systems theory

Epistemological hierarchy

Bunge's terms are in brackets; he does not include level (2).



Systems theory

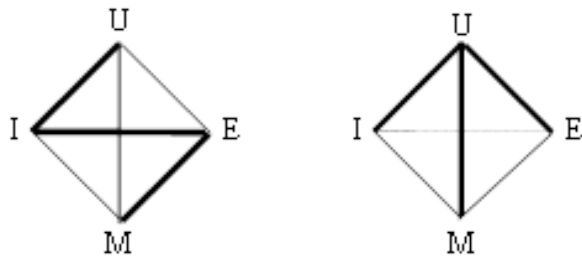
Transdisciplinarity of some systems theories

	Graph theory	Information theory	Nonlinear dynamics	Thermo- dynamics	Control theory	Game- decision theory	Generalized evolution
DISCIPLINES							
Sociology	•	•	•		•	•	•
Psychology	•	•	•		•	•	•
Biology	•	•	•	•	•	•	•
Chemistry	•	•	•	•	•		
Physics	•	•	•	•			

Commentary

Utility as a 4th fundamental category (for *concrete* systems)

M = matter, E = energy, I = information, (N = norm), U = utility



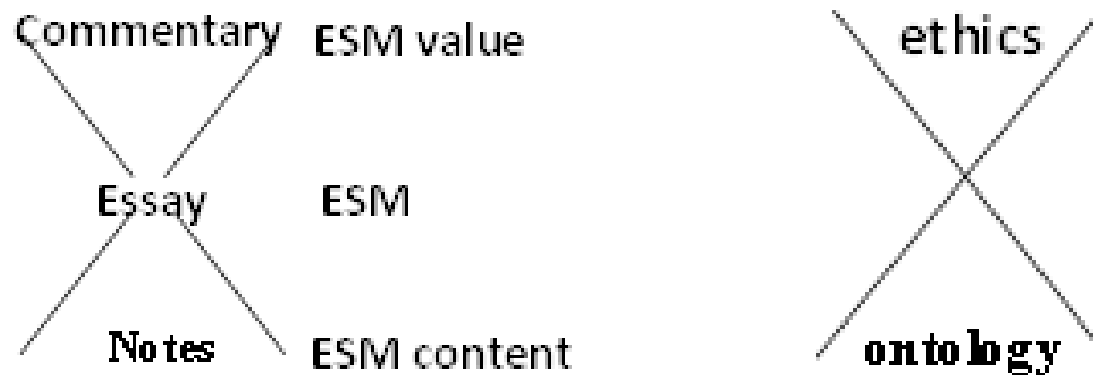
I, U have ***no physical units***

Information theory (I), game theory (U) central to emergence of systems theory after WWII

Table 4 **Some categories and systems theories**

<i>Category</i>	<i>Systems theory</i>
(what?)	
utility	game/decision theory
norm	control theory
information	information theory
energy	thermodynamics/statistical mechanics; generalized chemistry
matter	thermodynamics/statistical mechanics; generalized chemistry

Three parts & purposes of book



- **Essay** (Ch. 1): an exemplar of SM, organizes systems ideas (**Ontology**) & offers a *metaphysics of problems* (**Ethics**) (pp.7-38) (similar to Troncale's work on *systems pathologies*.)
- **Commentary** (Ch. 2-6): explains what systems theory is & its external context (**ESM value**) (pp.43-284)
- **Notes** (Ch. 7): presents mini-essays on systems ideas, theories (**ESM content**) (pp.285-590): *a textbook*

Essay

Organized from more general systems ideas to less general systems ideas

- **1.1 Synchronics (Being)**
- 1.1.1 Wholeness
- 1.1.2 Constraint (structure)
- 1.1.3 Distinction (function)
- 1.1.4 Persistence
- 1.1.5 Identity
- 1.1.6 Agency (function)
 - 1.1.6.1 Texture
 - 1.1.6.2 Other Systems
 - 1.1.6.3 Embeddedness
- 1.1.7 Complexity (structure)
 - 1.1.7.1 Networks
 - 1.1.7.2 Hierarchies
- 1.1.8 Cognition
- 1.1.9 Summary

Organized via a life cycle scheme

- **1.2 Diachronics (Becoming)**
- 1.2.1 Origin
- 1.2.2 Development
- 1.2.3 Limitation
- 1.2.4 Complexification
 - 1.2.4.1 Segregation
 - 1.2.4.2 Systematization
- 1.2.5 Internal opposition
- 1.2.6 Texture
- 1.2.7 Other systems
- 1.2.8 Embeddedness
- 1.2.9 Impermanence

Narrative theme:

metaphysics of problems

Essay

From Synchronics 1.1.6 **Agency** (external function) 1.1.6.1 Texture

...No plan survives contact with reality. Every action by a system is resisted by its environment. The nature of this resistance cannot fully be foreseen. No action generates only one effect. There are always externalities. Actions have unanticipated consequences, even counterintuitive effects. What should suppress perversely stimulates; what should stimulate unexpectedly suppresses. Effective action may require pursuit of apparently undesirable ends.

There is no terminus to the effects of action. Outcomes multiply into the future, and a final outcome never arrives. Even if initial effects are small, later effects can be large. Even were outcomes predictable and future utilities known, the relative weights that ought to be given to near- and far-term outcomes remain uncertain. For unrestricted action, the present must be free to bind the future, yet when the future arrives, action is restricted.

Moreover, optimization requires unity of purpose, but purpose is multiple and inconsistent. Purposes conflict. Imperatives of structural identity differ from those of functional identity. Multiple objectives are usually incommensurable, but even when they have a common utility scale, arbitrariness cannot be avoided. When utility is ordinal, no method exists to aggregate multiple preferences into a rational, decisive, and equitable choice...

Essay

*From Diachronics 1.2.5 **Internal opposition** (internal structure)*

Limitation may be internal and specific. Incompleteness and inconsistency engender development but also obstacles to development. As a response to incompleteness or as an intensification of inconsistency, there may emerge within the system a competing order. Every system is flawed, and every flaw in a system is a potential nucleation site for an alternative organizing principle...

Generally, every system is pulled in opposite directions by fundamental polarities. If it is organized around one extreme, the other extreme is a potential challenger. Alternatively, difficulties of development may arise not from original incompleteness but from original inconsistency. The system may contain two organizing principles: one dominant and the other subordinate...

But to the degree that the alternative principle is only a denial it offers no basis for a new order. What succeeds as negation never succeeds as affirmation. Negation, to supplant what is rejected, must be more than a corrective; it must offer a positive principle. But to be effective, negation yields to excess and distortion: excess in promotion of the new, distortion in rejection of the old. No order was ever overturned while being granted its due. In the heat of conflict, no delicate titration of opposing principles can be accomplished. Means can never be calibrated precisely to ends. Every correction overshoots.

Commentary

- **Ch. 2 An exact and scientific metaphysics**
- 2.1 The illusion of the fundamental
- 2.2 The systems alternative
- 2.3 A new conception of metaphysics
- 2.4 Epistemological niche of systems theories
- 2.5 Theories and models; the idea of “system”
- **Ch. 3 Concepts and categories**
- 3.1 Substance and form
- 3.2 Matter, energy, information; utility
- 3.3 Isomorphism and emergence
- 3.4 Aspects of complexity and holism
- 3.5 Structure, function, and history
- **Ch. 4 Related fields**
- 4.1 Not just mathematics
- 4.2 The relevance of physics
- 4.3 The centrality of biology
- 4.4 Sciences of the artificial
- 4.5 Systems theory and systems analysis
- **Ch. 5 The challenge of integration**
- 5.1 No *singular* systems theory
- 5.2 Hierarchy of system types
- 5.3 Categories of complexity
- 5.4 Ontology of problems
- 5.5 Metaphysician’s desk manual
- **Ch. 6 Science, religion, politics**
- 6.1 A macro-historical model
- 6.2 The new science
- 6.3 Natural religion
- 6.4 Fixing the world
- 6.5 Summing Up: promise of the systems project

Commentary

Idea/example pairs about **Agency**: Commentary 5.1 Metaphysician's Desk Manual

...Actions have unanticipated consequences, even counterintuitive effects. What should suppress perversely stimulates; what should stimulate unexpectedly suppresses ([1.1.6.1.2.6](#)). Overuse of antibiotics promotes evolution of resistance; a bacterial strain has been found that is even dependent on the antibiotic used against it. New highways can increase congestion. Suppressing fires builds up flammable fuel, which when fire finally breaks out makes the fire that much more severe. Adding nutrients to an ecosystem can cause it to collapse.

For unrestricted action, the present must be free to bind the future, yet when this future arrives, action has become restricted ([1.1.6.1.3.5](#)). The loss of freedom that comes with parenthood is never fully anticipated.

Multiple objectives are usually incommensurable, but even when they have a common utility scale, arbitrariness cannot be avoided ([1.1.6.1.4.4](#)). In decision-making by individuals, groups, organizations, and societies, optimizing multiple goals by first reducing them to a common denominator, e.g., dollars, is always highly arbitrary.

Commentary

Idea/example pairs about **Agency**: Commentary 5.1 Metaphysician's Desk Manual

...When utility is ordinal, no method exists to aggregate multiple preferences into a rational, decisive, and equitable choice ([1.1.6.1.4.5](#)). Some democratic decision-making procedures are intrinsically imperfect. Specifically, preferential voting schemes, faced with three or more choices, suffer from irrationality, inequality, or indecisiveness.

Local optimization is usually suboptimal since the risky search for maximal gain foregoes assured, though inferior, benefits. The best is the enemy of the good....The good is the enemy of the best ([1.1.6.1.5.4](#)). In politics, social and economic policy, organizational behavior, and personal choice, there is always tension between incremental improvement and radical change, realism and idealism, satisficing and optimizing.

Even if attained, optimality brings risk. it reduces diversity and redundancy, which diminishes resilience ([1.1.6.1.7.4](#)). Minimizing inventories may enhance efficiency, but systems without reserves are fragile because they have no buffers to cushion external shocks. Optimality sought by being lean is often illusory because risk is merely ignored, transferred, or hidden. Nor is lean necessarily ecologically beneficial...

Commentary

Some aspects of “complexity”

Simplicity/reductionism:

low ordinality relations
linear relations
lineal causality
local causality
necessity or chance
fine-grained view of some parts
one (or two) levels
no emergent phenomena
structure (or function or history) only

Complexity/holism:

high ordinality relations
nonlinear relations
mutual (feedback), branching causality
global causality
necessity *and* chance
coarse-grained view of the whole
multiple levels
emergent phenomena
structure and function and history

Notes (1/2)

Synchronics

- **Wholeness**
- **1 System**
- 2 Organizing principle
- **3 Relation**
- **4 Incompleteness**
- 5 Structure
- **6 Inconsistency**
- 7 Networks
- 8 Incompleteness vs. inconsistency
- **Constraint**
- 9 Relation as constraint
- 10 Dynamic relation
- 11 Echoing the primary tension
- **12 The potential and the actual**
- 13 Order
- **14 Entropy**
- 15 Scale
- 16 Order & disorder are intertwined
- **17 Chaos**
- 18 Unity and multiplicity
- 19 Aggregates vs. systems
- 20 Reconciling constraint and variety

• **Distinction**

- **21 Distinction**
- 22 Environment
- **23 Disequilibrium & existence**
- **24 Boundary**
- **25 Fuzziness**
- **26 Fractals**
- 27 External relation
- 28 Extension
- 29 Nothing, many, one, all
- 30 One, two, three, ten thousand
- 31 Assertion vs. integration
- **32 Emergence**
- 33 Engaging/disengaging
- 34 Active vs. passive
- 35 Function

• **Persistence**

- **36 Stability**
- **37 Catastrophe theory**
- 38 The fold catastrophe
- **39 The Second Law**
- 40 Rigidification vs. disintegration
- 41 Openness and Closedness
- **42 Dissipative systems**
- 43 Openness necessary & hazardous
- **44 Law of Requisite Variety**
- **45 Feedback control**
- **Identity**
- 46 Information (and matter-energy, utility)
- **47 Autopoiesis**
- **48 Algorithmic information**
- 49 Genotype and phenotype
- 50 Internal vs. external identity
- 51 Paradoxes of autonomy
- 52 Dangers of filtering out noise
- 53 Boundary subsystem

Notes (2/2)

Synchronics

- **Agency**
- **54 Utility**
- 55 Environmental types
- **56 Decision theory**
- 57 Chaos and long-term forecasting
- 58 Nature resists
- 59 Multiplication of effects
- **60 Externalities**
- **61 Counterintuitive effects**
- 62 Weakening by strengthening
- 63 No terminus
- **64 Discounting the future**
- 65 Binding the future and sunk costs
- **66 Pareto-optimality**
- 67 Multiple objectives
- 68 Aggregating preferences
- 69 Computational complexity
- **70 Optimization**
- 71 Optimality, stability, and resilience
- 72 Purposeful action as a tetrad
- 73 Assertion, integration, exchange
- 74 Eating and being eaten
- **75 Game theory**
- 76 Coalition instability
- 78 Prisoner's Dilemma
- 79 Chicken
- 80 Altruism may be harmful
- 81 Sharing elements
- 82 Heteronomy
- 83 Recruitment and predation
- 84 Embeddedness may solve PD
- 85 Turbulent fields
- **Complexity**
- **86 Complexity**
- 87 Individuality and complexity
- **88 Hierarchies and networks**
- 89 Complexity, stability, & chaos
- 90 Small worlds
- **91 Scale-free networks**
- 92 Homo/heterogeneity, scale
- 93 Three levels
- 94 The highest is not the whole
- 95 Hierarchical egalitarianism
- 96 Distillation and alienation
- **97 Informational parasitism**
- **Cognition**
- 98 A naturalistic epistemology
- **99 The modeling subsystem**
- 100 Tetrad of modeling
- 101 Pragmatic, semantic, syntactic
- 102 Multiple subselves
- 103 Self and non-self
- 104 Embeddedness of cognition
- 105 Cognition and time
- **106 Constructing reality**
- 107 Representation
- 108 Cognition and autopoiesis
- 109 Relativity of models
- 110 Fallibility
- 111 Modeling constraint
- **112 Sensitivity and specificity**
- 113 Wrong perception
- **114 Self-reference**
- **Summary**
- 115 Binary oppositions
- 116 Dyadic correlations
- **117 Dialectics**
- 118 The extremes are attractors
- 119 The war of universality on uniqueness

Appendix

(pp.591-611) An attractive feature of an ontology of problems is that its concepts can articulate its own deficiencies...Every doctrine needs to own up to its imperfections, ... try to recognize, assume responsibility for, and remedy its omissions and distortions...It is an obligation of every system to try to put its own house in order.

A. Auto-critique

A.1 Structure

A.1.1 Abstraction

A.1.2 Inexactness

A.1.3 Metaphor

A.1.4 Rhetoric

A.1.5 Scope

A.2 Function

A.2.1 Problematics

A.2.2 Diagnostics, Therapeutics

A.2.3 Euphorics, an antidote

Thank you.

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On pull-down menu, category: Systems Theory and Philosophy