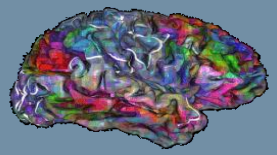
The 2nd International Conference on Anticipation

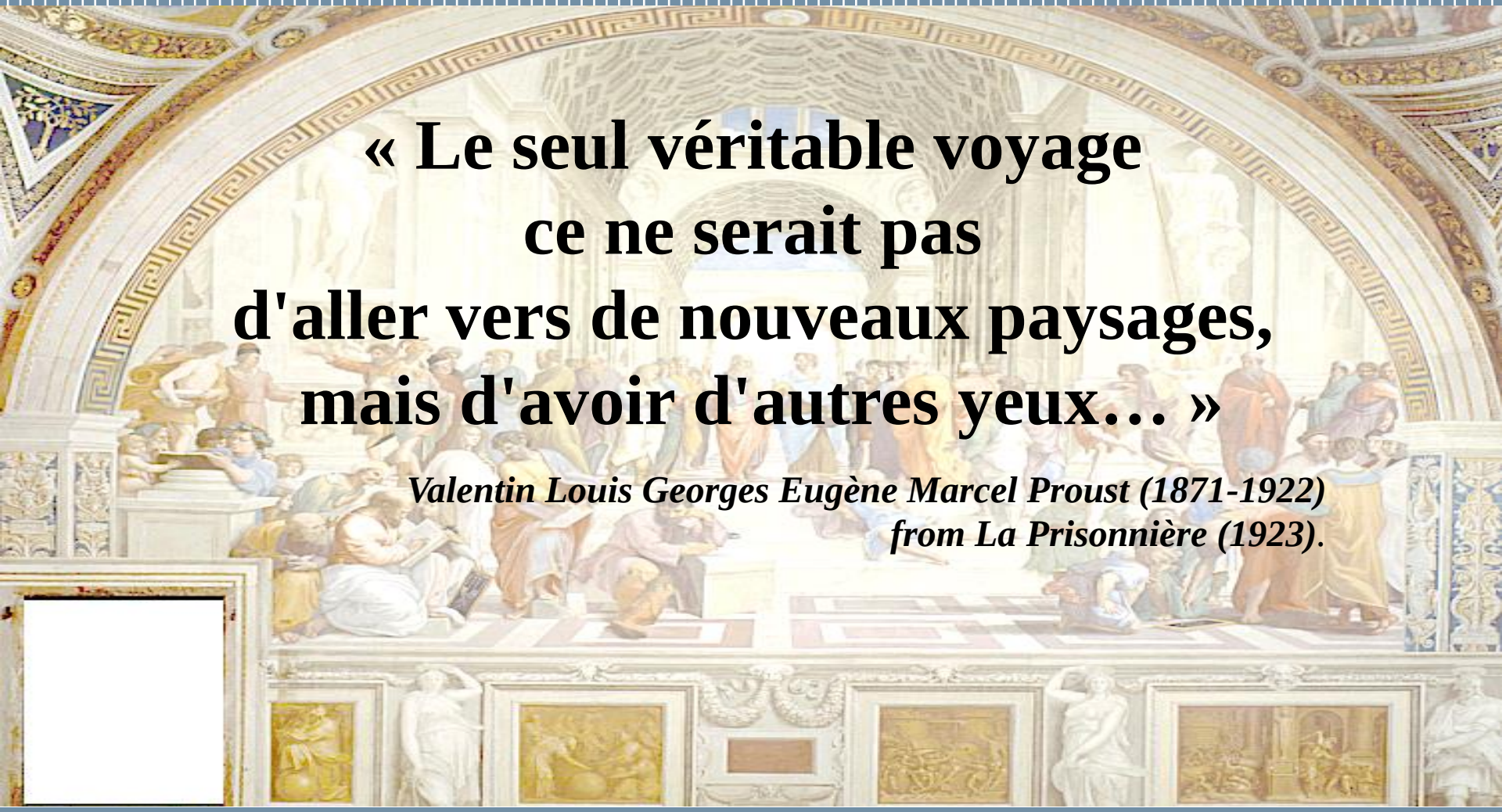
Senate House, School of Advanced Study, London, UK 8 – 10 Nov, 2017

Anticipation 2017

To Govern the Future We Need Anticipation First: No Anticipation No System Antifragility

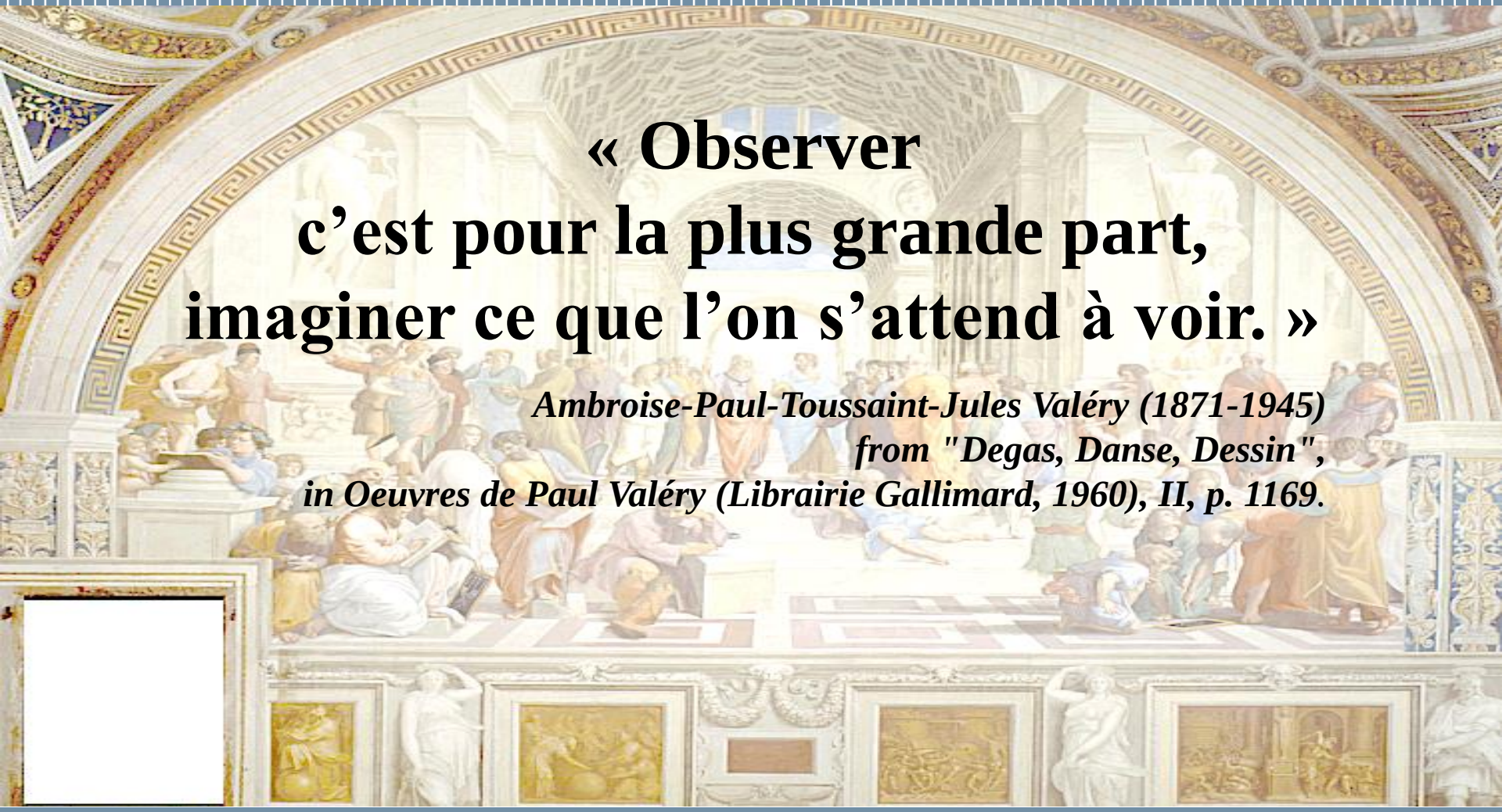


Rodolfo A. Fiorini



« Le seul véritable voyage
ce ne serait pas
d'aller vers de nouveaux paysages,
mais d'avoir d'autres yeux… »

Valentin Louis Georges Eugène Marcel Proust (1871-1922)
from La Prisonnière (1923).



« Observer
c'est pour la plus grande part,
imaginer ce que l'on s'attend à voir. »

Ambroise-Paul-Toussaint-Jules Valéry (1871-1945)
from "Degas, Danse, Dessin",
in Oeuvres de Paul Valéry (Librairie Gallimard, 1960), II, p. 1169.

Presentation Outline

1. Introduction (12)
   - Current Hierarchical System Operative Limitation
   - Complex (Multi-Scale) System Modeling
2. Communication Complexity (07)
   - Propositional Logic Proficiency
   - Purposive Actor Value Definition
3. Elementary Dichotomy Process (03)
   - Spacetime Splitting
   - Systemic Learning Basic Scheme
4. Ontological Uncertainty Management (OUM) (17)
   - System Non-Linearity and Complexity
   - Natural Living Organism Antifragility
5. Conclusion (04)
   - Post-Bertalanffy Systemics Framework Proposal
   - Main References

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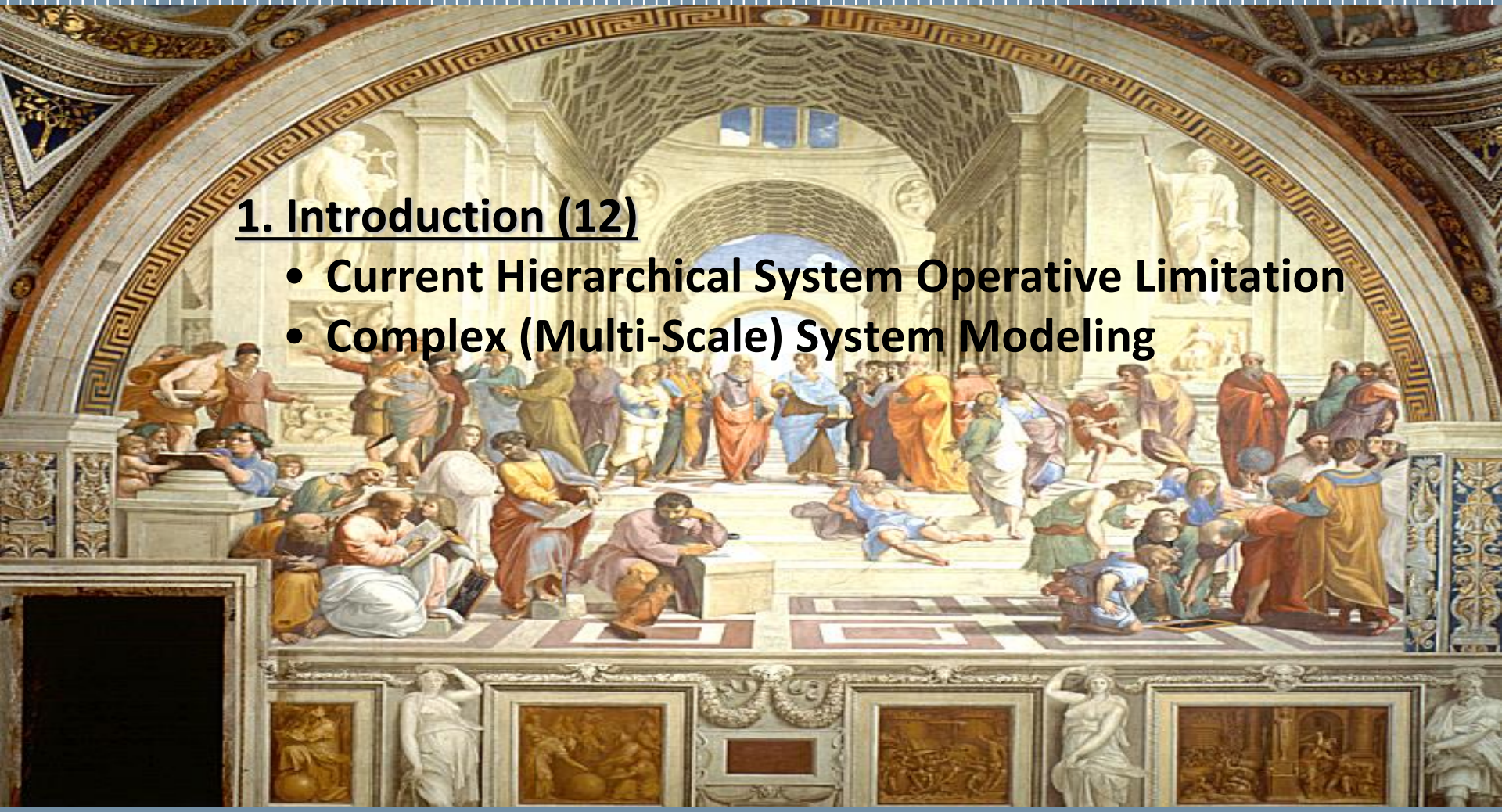

1. Introduction (12)

- Current Hierarchical System Operative Limitation
- Complex (Multi-Scale) System Modeling

Current System Fragility

Attempts to optimize hierarchical systems in the traditional top-down way will be less and less effective, and cannot be done in real time (Fiorini, 2016). In fact, current human made application and system can be quite fragile to unexpected perturbation because Statistics by itself can fool you, unfortunately (Taleb and Douady, 2015).

Current most advanced "intelligent system" is a "deficient system", a fragile system, because its algorithms are still based on statistical intelligence or statistical knowledge only, and they are lacking a fundamental system component.

Current System Fragility

We need more robust resilient and antifragile application to be ready for next generation systems. What Taleb has identified and calls "antifragility" is that category of things that not only gain from chaos but need it in order to survive and flourish and proposes that things be built in an antifragility manner.

The antifragility is beyond the resilient. In turn, the resilient is beyond the robust. The robust fails when perturbations are out of its preprogramed operative range. The resilient resists shocks and stays the same; the antifragility gets better and better.

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Current scientific computational and simulation classic systemic tools and most sophisticated instrumentation system (developed under the positivist reductionist paradigm and the "**continuum hypothesis**", **CH** for short) are **still totally unable to capture and to discriminate** so called "**random noise**" (**RN**) from any combinatorically optimized encoded message, called "**deterministic noise**" (**DN**) by **computational information conservation theory** (**CICT**) (Fiorini, 2014a).

This is the **information double-bind** (**IDB**) dilemma in current science, and nobody likes to talk about it (Fiorini, 2016).

How does it come that scientists 1.0 (statisticians) are still in business without having worked out a definitive solution to the problem of the logical relationship between experience and knowledge extraction? We need to extend our systemic tools to solve this IDB dilemma first and then to achieve real machine intelligence to open a new era of effective, real cognitive machine intelligence (Wang et al., 2016).

What is an Arbitrary Complex Multiscale (ACM) System?

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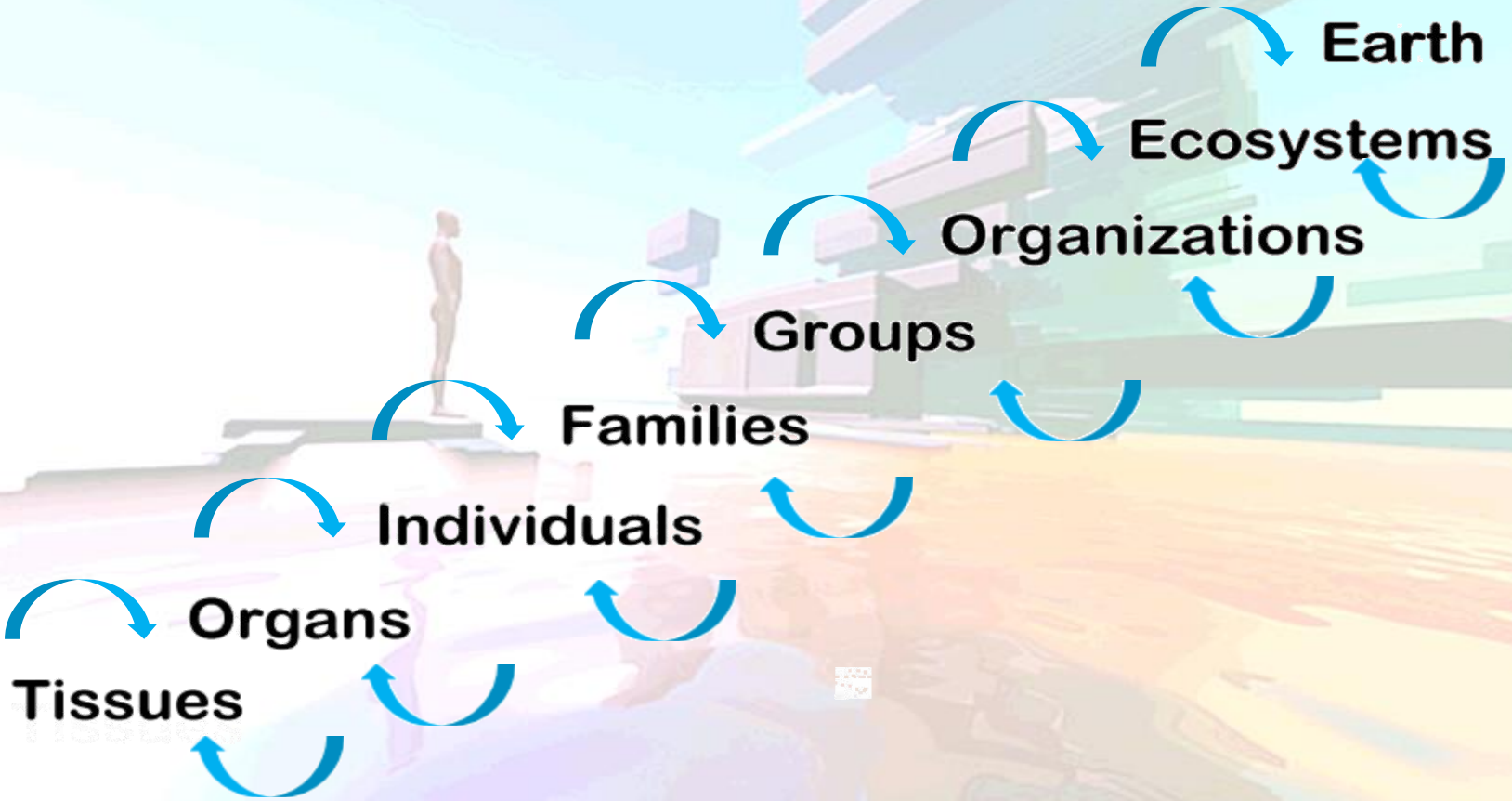
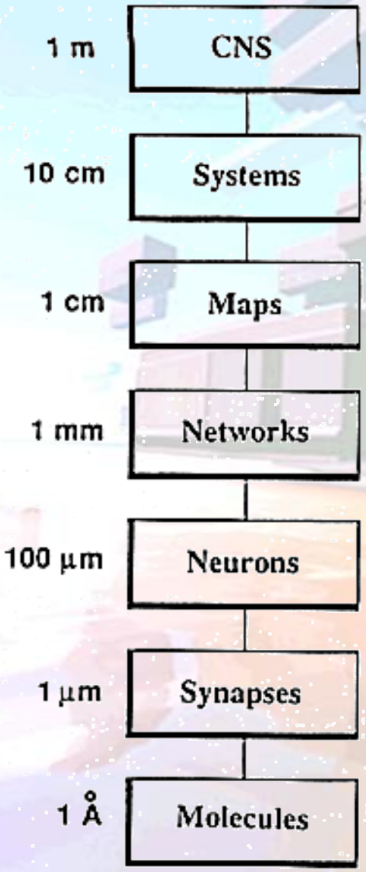
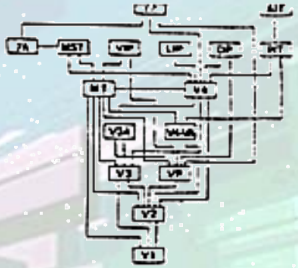
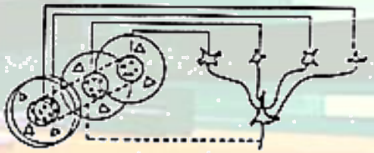
Example of Arbitrary Complex Multiscale System (ACM)



Example of Arbitrary Complex Multiscale System (ACM)







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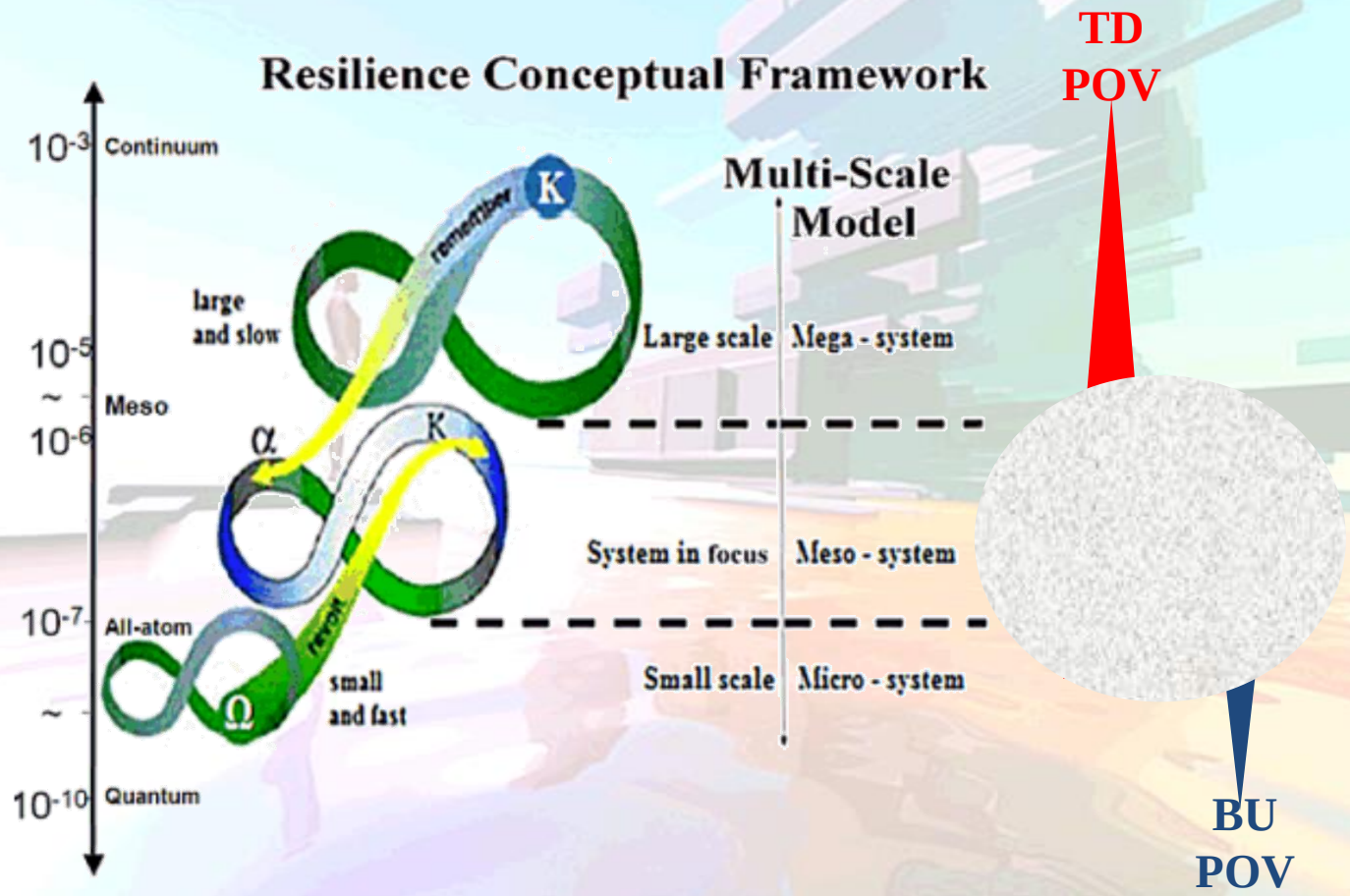
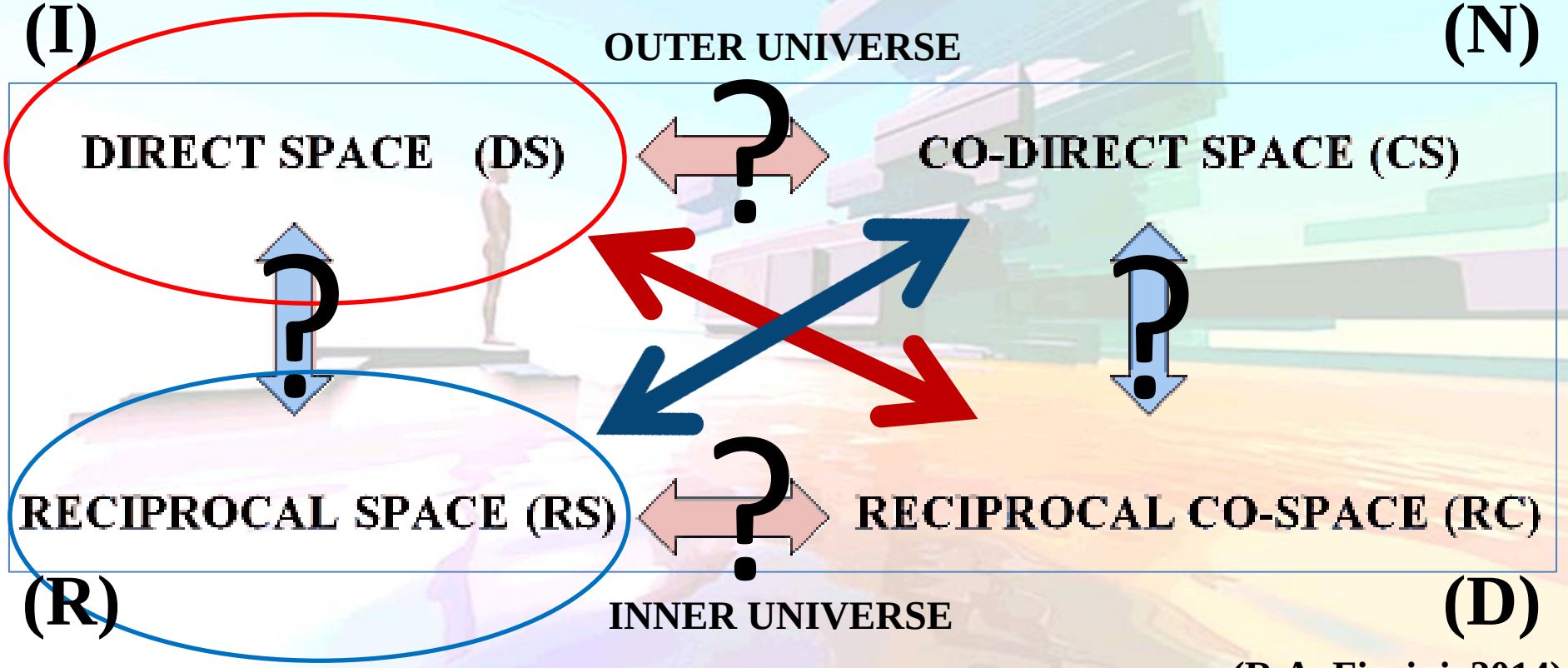
The Root of the Current Problem for ACM System Modeling



INNER vs. OUTER UNIVERSE (IOU) Mapping By KLEIN Four-Group (CICT)



(R.A. Fiorini, 2014)

Current System Fragility

Since the pioneering application of Cybersyn to the Chilean economy in the early 1970s (Espejo, 2014) **to the recent revisiting of The Viable System Model** (VSM), developed by **Stafford Beer** (b.1926 – d.2002) (Beer, 1972), there has been always a need to understand how complexity is managed in viable organizations (Espejo and Harnden 1989).

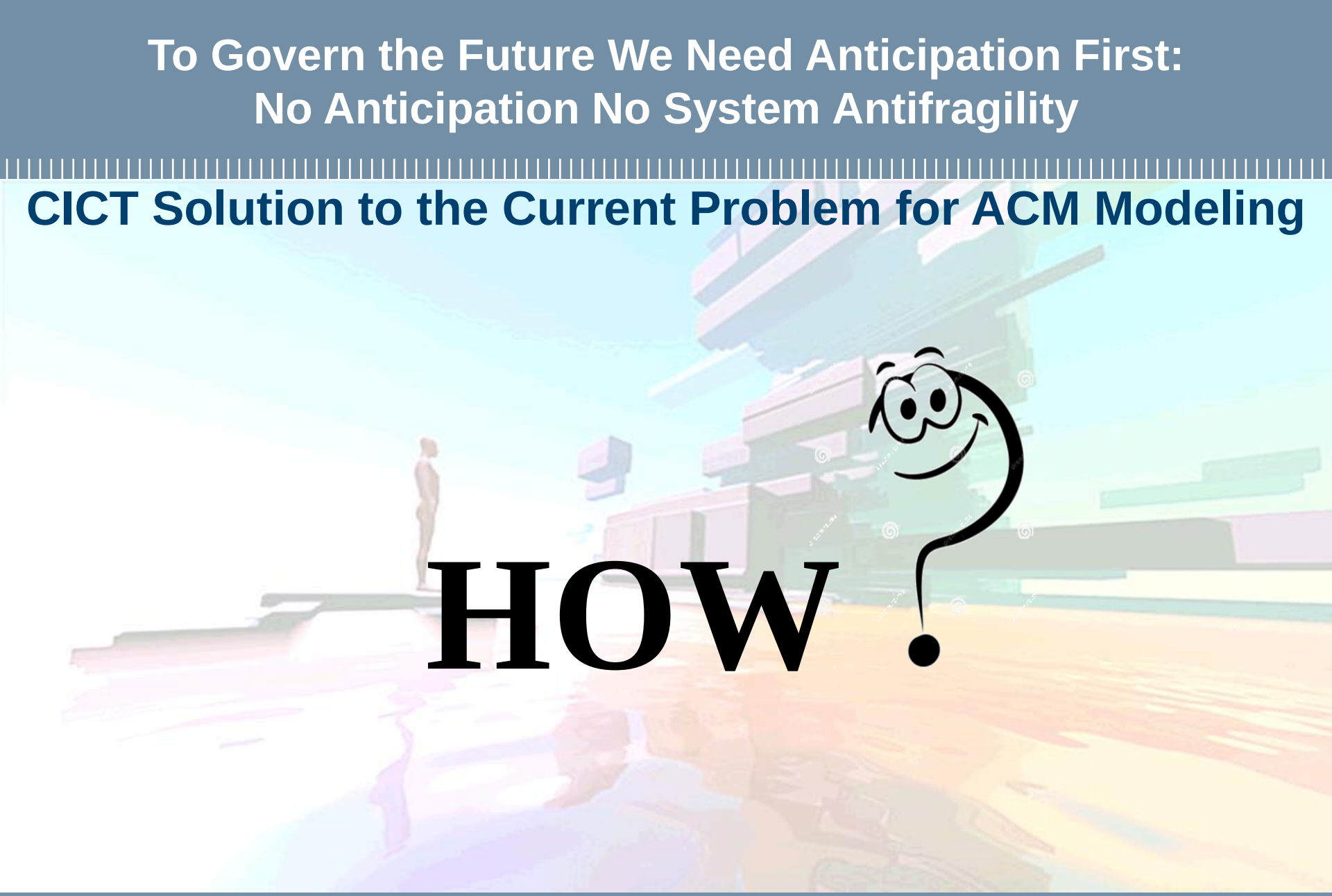
Today, environmental conditions are quite different from the 1970s and they are continuously changing at an increasing rate. While the amount of data doubles every **1.2** years and the processing power doubles every **1.8** years, **the complexity of networked systems is growing even faster**.

Current System Fragility

Attempts to optimize hierarchical systems in the traditional top-down way will be less and less effective, and cannot be done in real time (Fiorini, 2016)**.**

The logical answer is to use **distributed (self-) control, i.e. bottom-up self-regulating systems. Advanced Cybernetics** (i.e. extended system theory) and **Complexity Theory** tell us that it is actually feasible to create resilient social and economic order by means of self-organization, self-regulation, and self-governance. Nevertheless, to achieve self-organization, self-regulation in a competitive arbitrary-scalable system reference framework, **we need application resilience and antifragility at system level first**.

CICT Solution to the Current Problem for ACM Modeling



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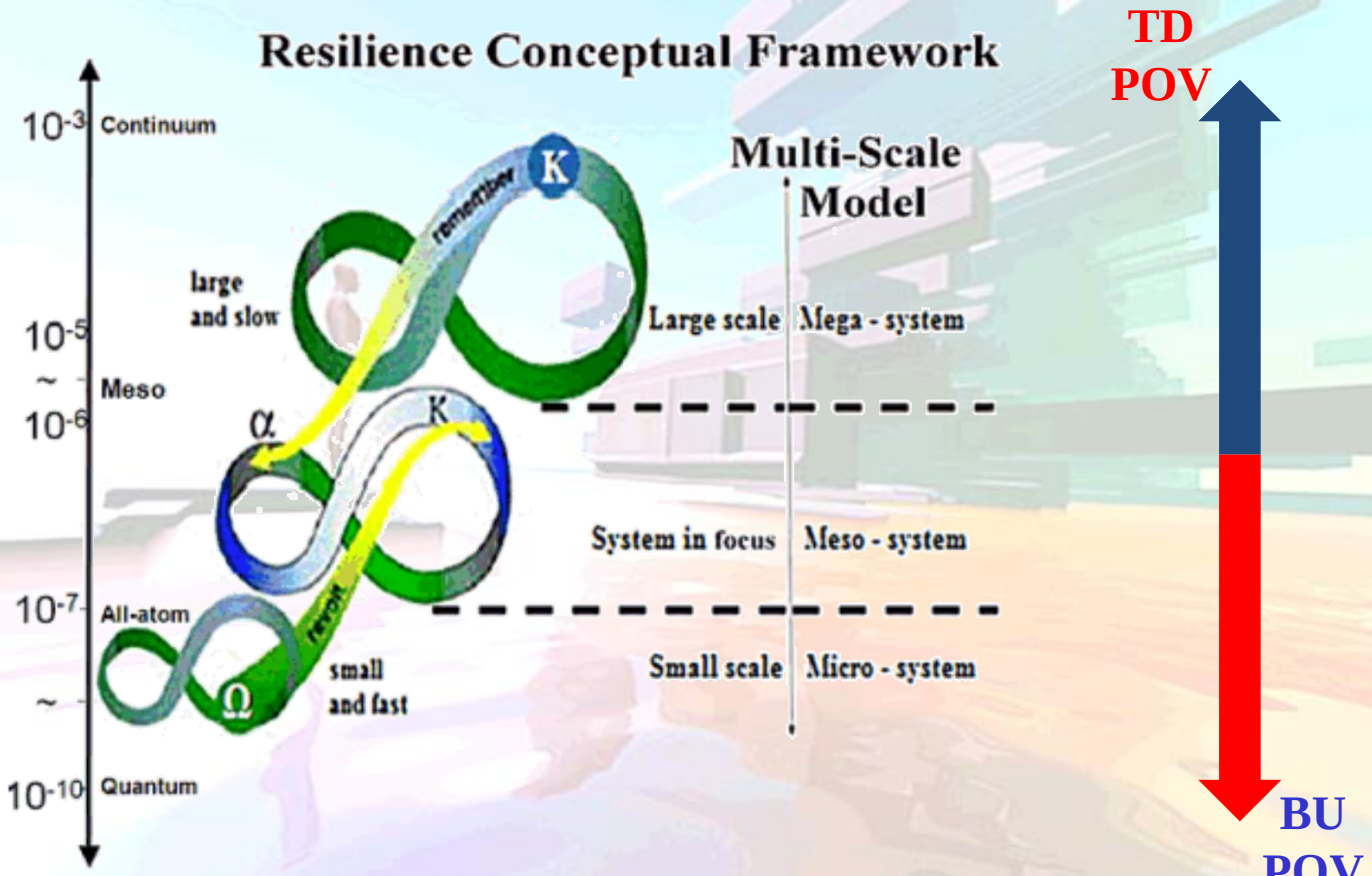
CICT Solution to the Current Problem for ACM Modeling



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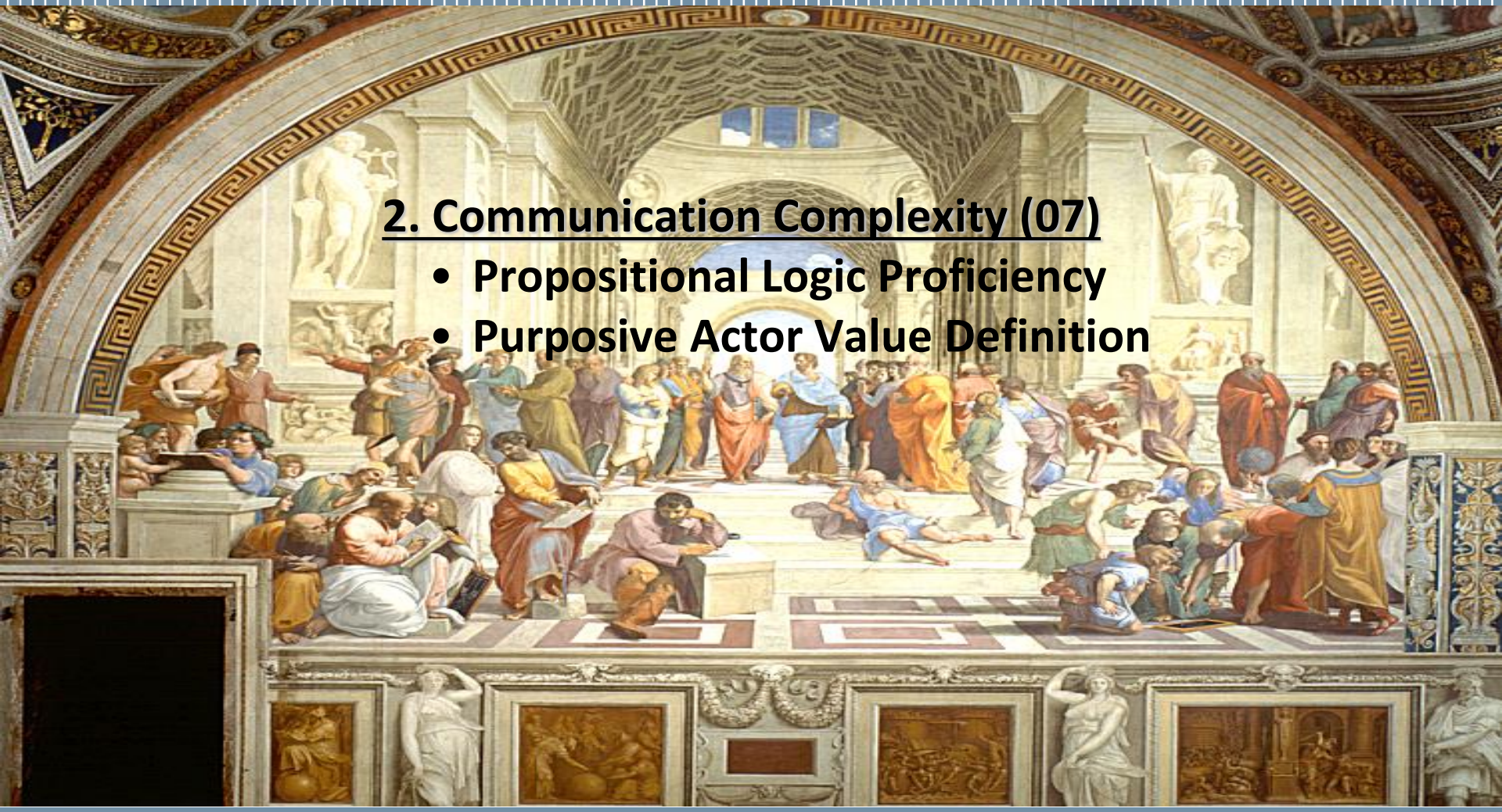

2. Communication Complexity (07)

- Propositional Logic Proficiency
- Purposive Actor Value Definition

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According to Swiss clinical psychologist **Jean Piaget**, human adults normally know how to use properly classical propositional logic. **Piaget also held that the integration of algebraic composition and relational ordering in formal logic is realized via the mathematical Klein group structure** (Inhelder and Piaget, 1955).

In the last fifty years, many experiments made by psychologists of reasoning have often shown most adults commit logical fallacies in propositional inferences. **These experimental psychologists have so concluded, relying on many empirical evidences, that Piaget's claim about adults' competence in propositional logic was wrong and much too rationalist.**

In other words, according to experimental psychologists, **Piaget was overestimating the logical capacities of average human adults in the use of classical propositional logical connectives.**

But, doing so, **they forgot Piaget's rigorous and important analysis of the Klein group structure at work in logical competence.**

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The Klein four-group is the smallest non-cyclic group, and every non-cyclic group of order 4 is isomorphic to the Klein four-group.

The cyclic group of order 4 and the Klein four-group are therefore, up to isomorphism, the only groups of order 4. Both are abelian groups in mathematics.

Piaget applied the Klein four-group to binary connectives, so that a given connective is associated first with itself (in an identical (**I**) transformation) and then with its algebraic complement (its inverse (**N**) transformation), also with its order opposite (its reciprocal (**R**) transformation) and finally, with the combination of its N and R transformations (that Piaget calls its "correlative" or C transformation) (Inhelder and Piaget,1955, ch.17.) This correlative corresponds to what logicians usually call the "dual" (**D**) transformation (Robert and Brisson, 2016).

The Klein group structure generates Squares Of Opposition (SOOs), **and an important component of human rationality resides in the diagram of the SOO**, **as formal articulations of logical dependence between connectives** (Beziau and Payette, 2012).

Piaget's KLEIN Four-Group Definition

x	I	N	R	D
I	I	N	R	D
N	N	I	D	R
R	R	D	I	N
D	D	R	N	I

Inhelder and Piaget, 1955

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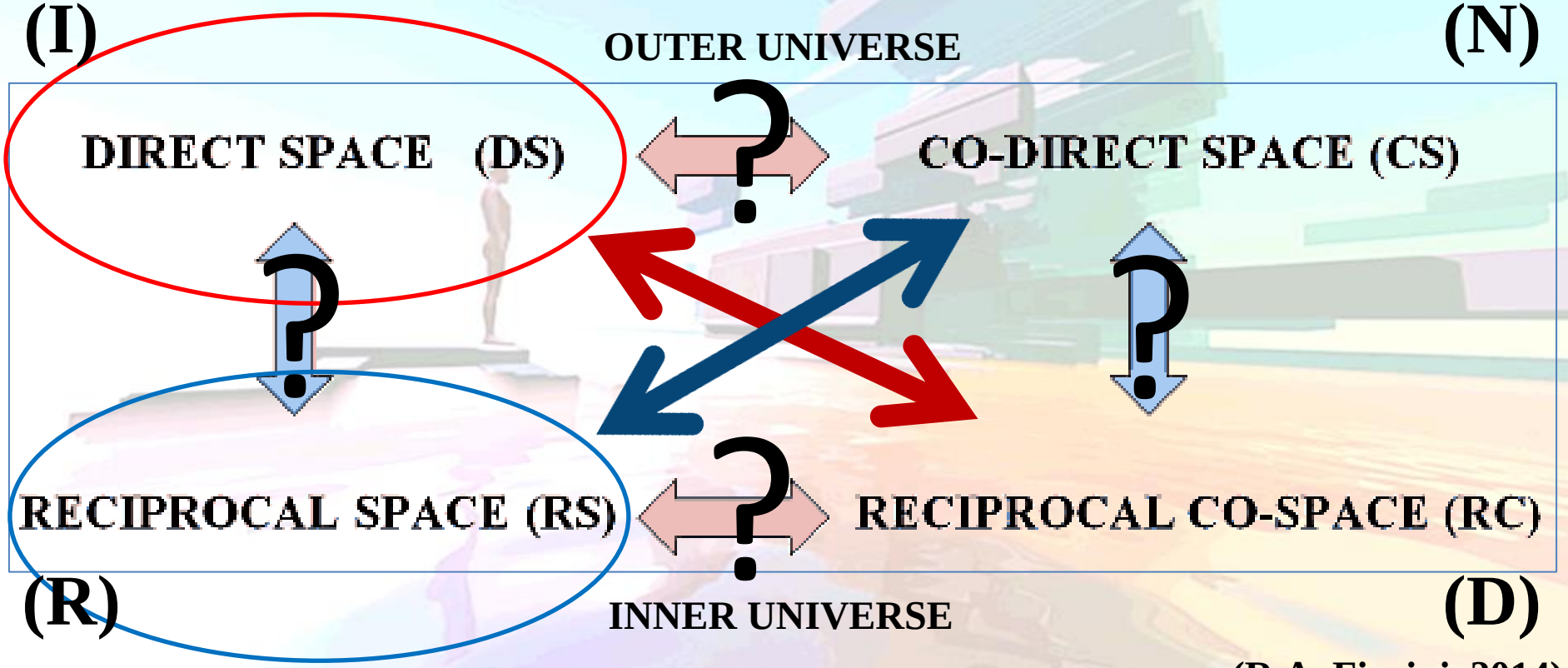
As a matter of fact, English talking people tend to treat conditionals as equivalences and inclusive disjunctions as being exclusive (Robert and Brisson, 2016).

We inevitably see the universe from a human point of view and communicate in terms shaped by the exigencies of human life in a natural uncertain environment. The diagram of the SOO is basic to formal articulations of logical dependence between connectives.

But the formal rationality provided by the SOO is not spontaneous and therefore, should not be easy to learn for adults.

This is the main reason why **we need reliable and effective training tools to achieve full propositional logic proficiency in decision making, like the elementary pragmatic model (EPM) and the Evolutive EPM (E^2PM)** (De Giacomo and Fiorini, 2017).

INNER vs. OUTER UNIVERSE (IOU) Mapping By KLEIN Four-Group (CICT)



(R.A. Fiorini, 2014)

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Purposive Actor Value Definition

OUTER UNIVERSE	INNER UNIVERSE - SELF
INTRINSIC, "Empathy" Other persons as unique individuals; the spiritual, irreplaceable worth of others; the value of a "thing" as it exists in itself.	INTRINSIC, "Self Esteem" The self as infinitely valuable; the unique individuality of each person; the understanding of "who" one is; actual strengths and limitations.
EXTRINSIC, "Practical Judgment" Material value; things; classes or groups of things; other things as they serve useful roles or have functional value; comparison of things, people or situations; concrete, functional value in general, practical concrete organization.	EXTRINSIC, "Role Awareness" "What" one is; the role function one plays; the sense of using time in a useful, functional way; career thinking; satisfaction or dissatisfaction with what one is doing in the world.
SYSTEMIC, "Systems Judgment" Analytical or structured thinking; structure, order or consistency in thinking; theoretical or conceptual organization and planning; valuing what "ought to be"; the rules.	SYSTEMIC, "Self Direction" "Where" one is going or "ought" to be going; self direction; persistence; drive motivated from commitment to inner principles and goals; self concept; ideal self image.

Hartman Axiological Value Definition for a Generic Entity (TD Approach)

1 INTRINSIC VALUE (All the Properties contained in the Meaning of the Name)

2 EXTRINSIC VALUE (Name with a Meaning defined by a Set of Properties)

3 SYSTEMIC VALUE (Certain Name)

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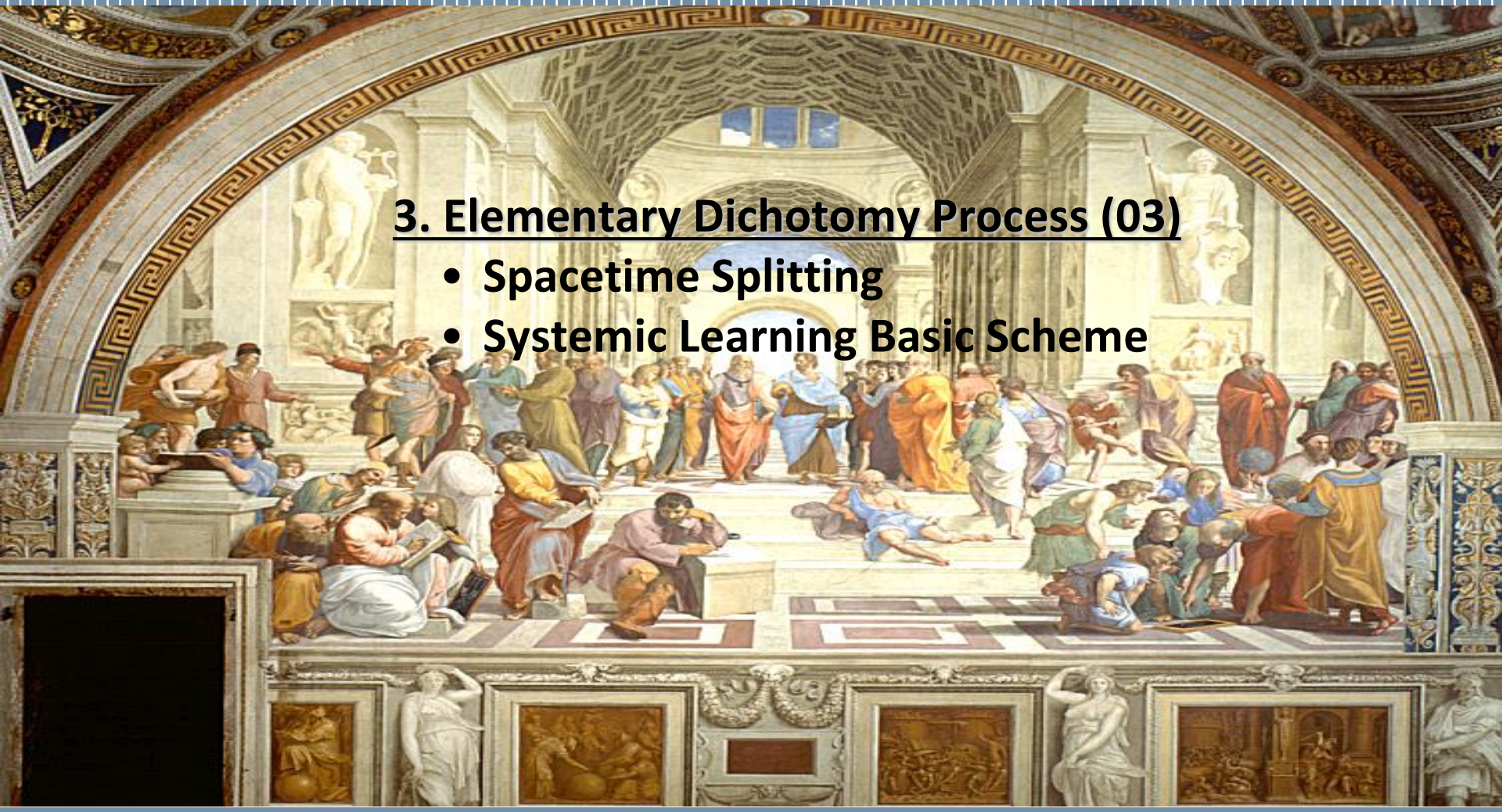

3. Elementary Dichotomy Process (03)

- Spacetime Splitting
- Systemic Learning Basic Scheme

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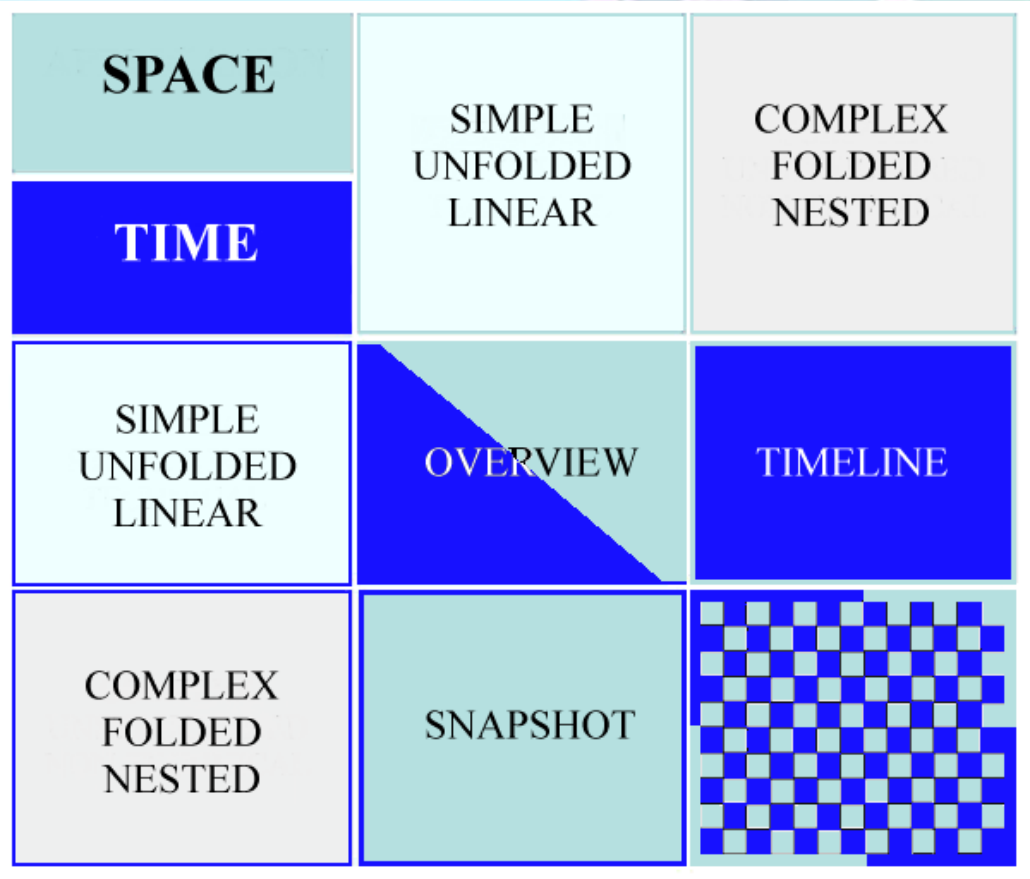
From Spacetime to Space-Time



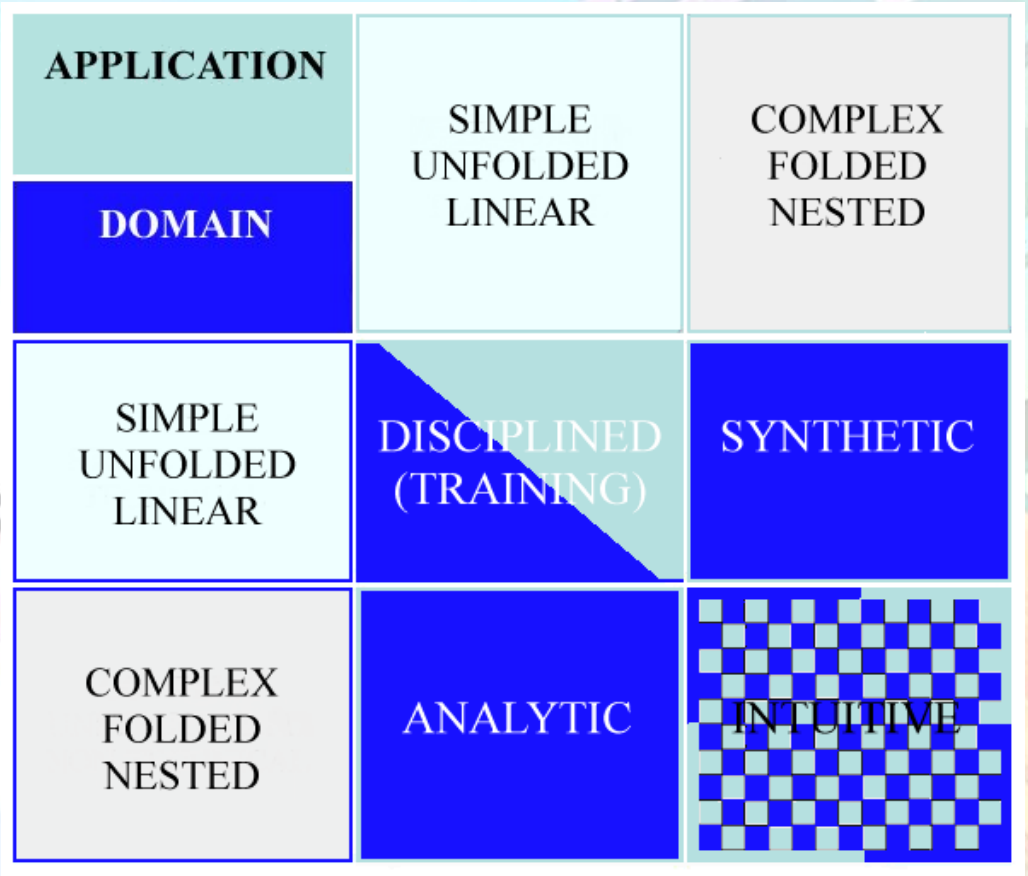
(R.A.Fiorini, 2016)

Statistics Can Fool You, Unfortunately

APPLICATION / DOMAIN	Simple payoffs	Complex payoffs
Distribution 1 ("thin tailed")	Extremely robust to Black Swans	Quite robust to Black Swans
Distribution 2 ("heavy" and/or unknown tails, no or unknown characteristic scale)	Quite robust to Black Swans	**LIMITS of Statistics – extreme fragility to Black Swans**

(N. Taleb, 2014)

Systemic Learning Basic Scheme



(R.A.Fiorini, 2016)

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4. Ontological Uncertainty Management (OUM) (17)

- System Non-Linearity and Complexity
- Natural Living Organism Antifragility

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To face the challenge of complex system understanding and reliable **arbitrary complex multiscale (ACM)** system modeling, we need to be able to control system uncertainty quantification from macroscale, through mesoscale, till nanoscale and beyond.

We need more robust, resilient and antifragile application to be ready for next generation systems. Attempts to optimize multi-scale systems in a top-down (TD) perspective will be less and less effective, and cannot be done in real time.

That is the main reason why, over the last few years, integration of stochastic methods into a multi-scale framework (from macro-scale to nano-scale) or development of multi-scale models in a stochastic setting for **epistemic uncertainty quantification** (UQ) is becoming an **emerging research frontier for systems modeling**, innovation and competitive development in Science and Technology.

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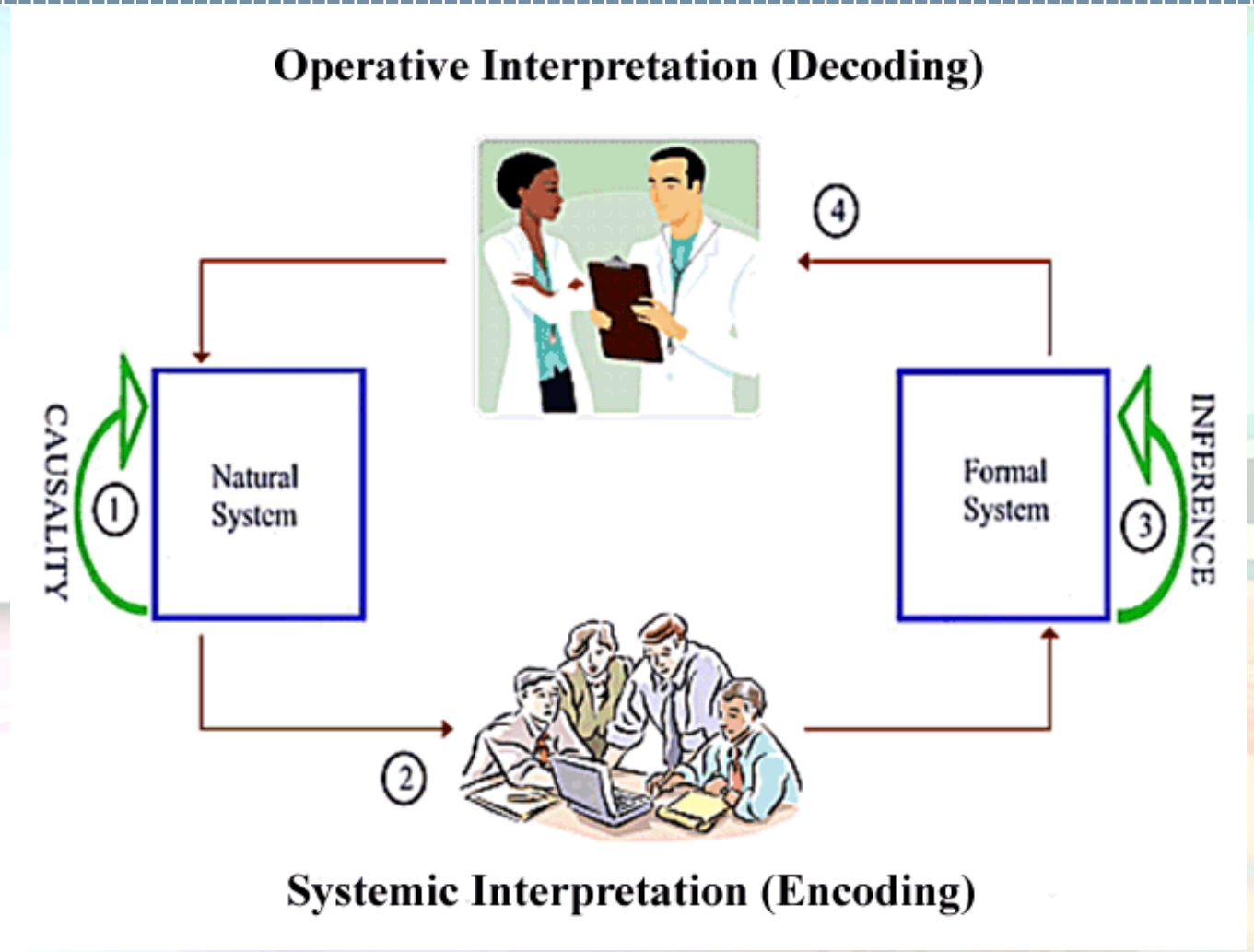
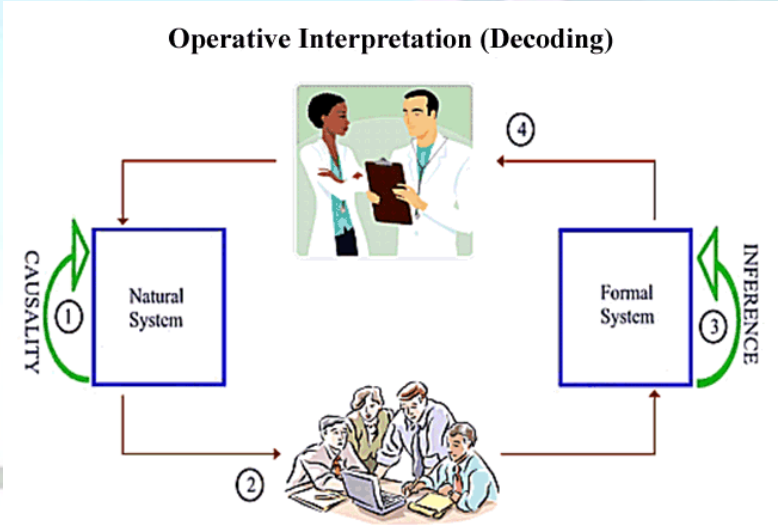
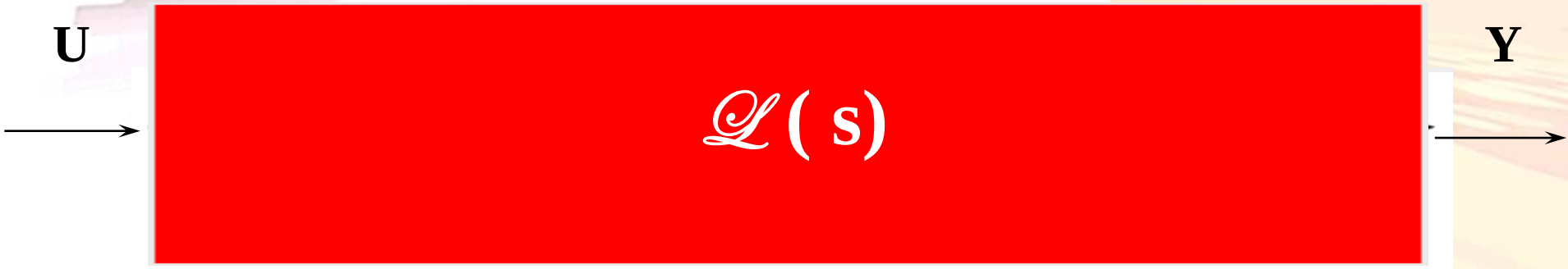


Linear Feedback Example (prognosis)



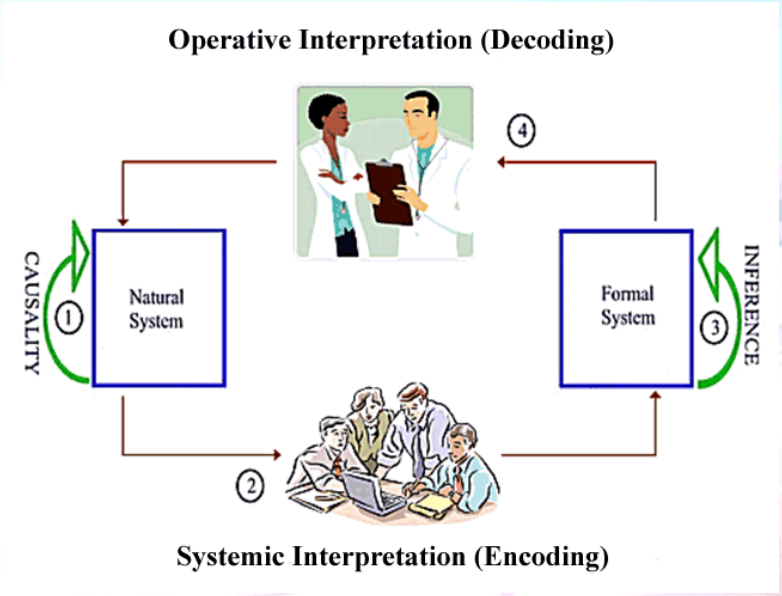


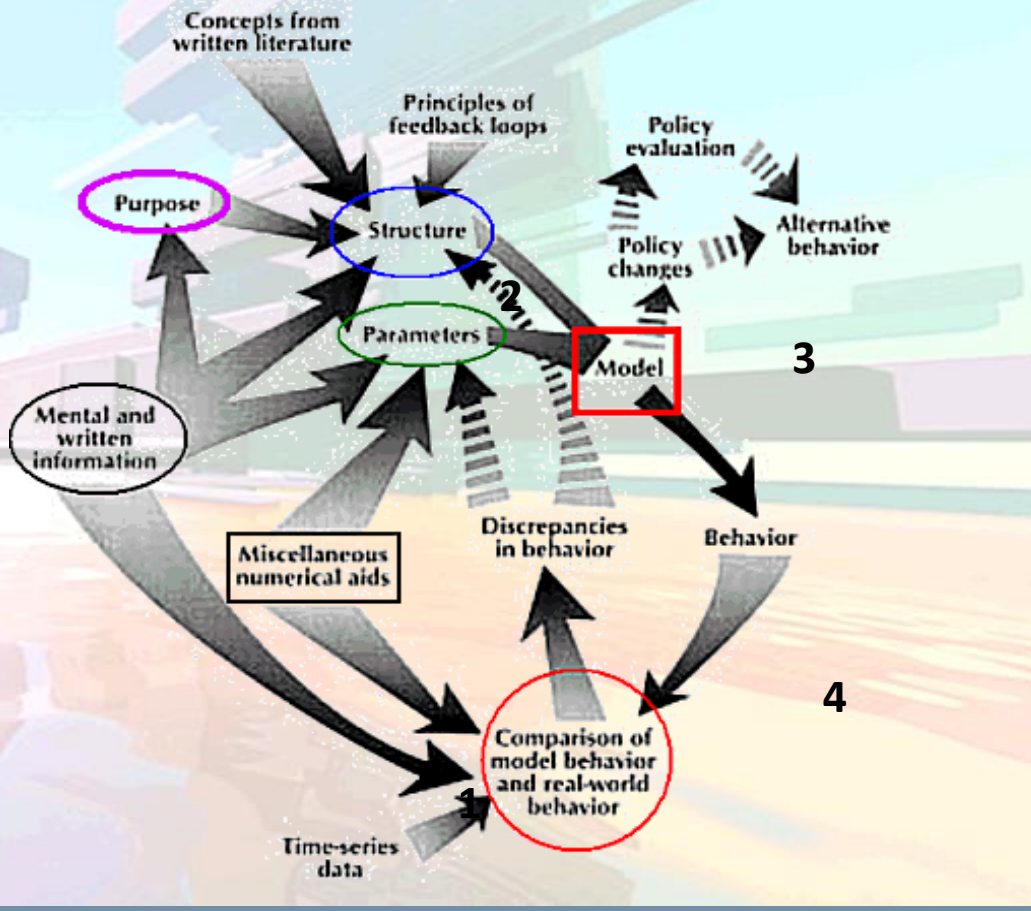
Complexity
is the impossibility of
separating a system from its context.

A living being from its environment.

An object from
its measuring instrument.

Nonlinear Feedback Example (complex system)

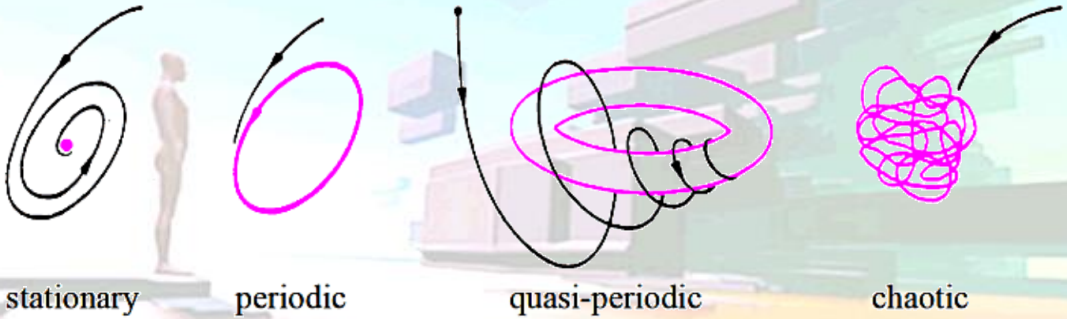




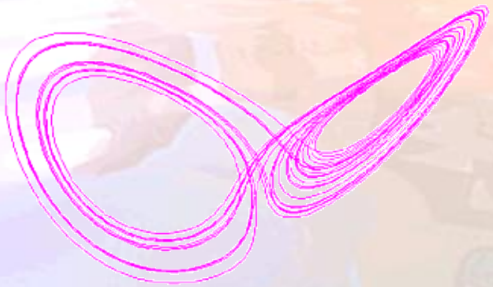
Four Possible Asymptotic Regimes

Dynamical system theory in a glance

Four possible asymptotic regimes



The Lorenz's attractor [1963]



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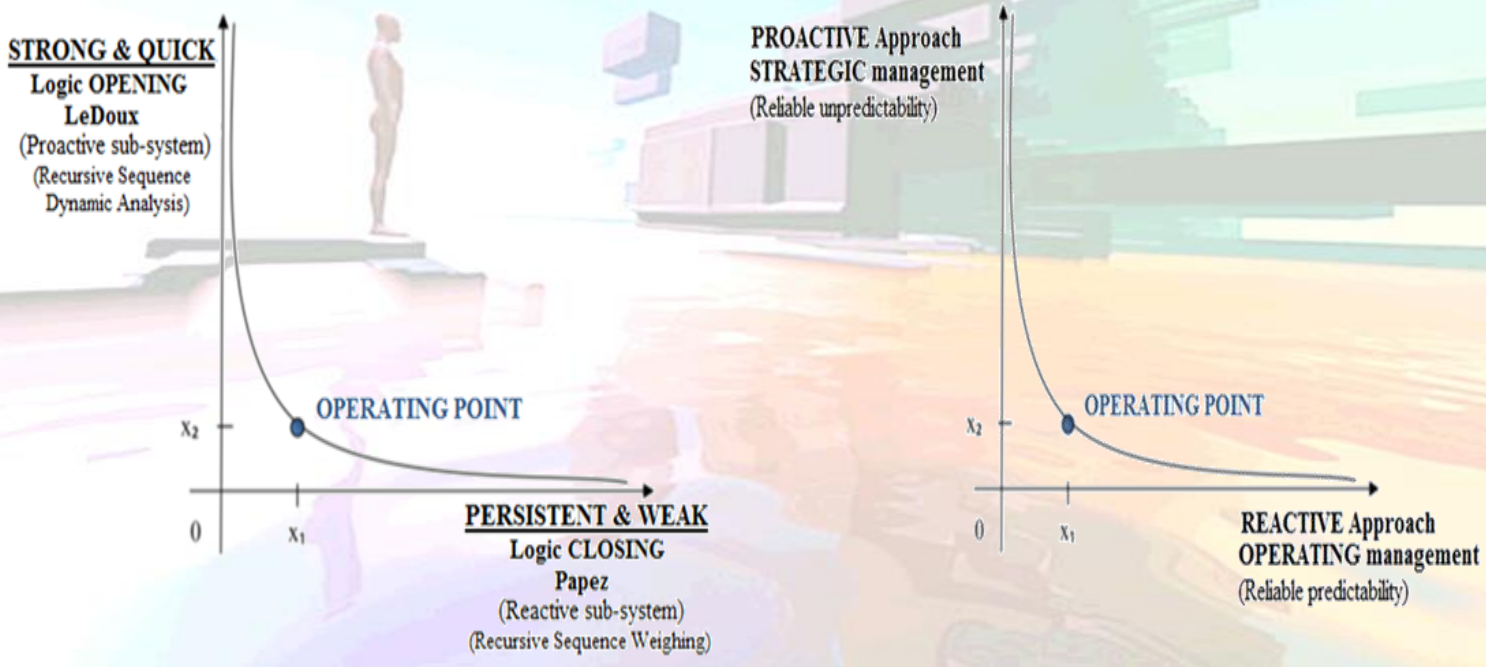
Two Irreducible Subsystems based on Ideal Asymptotic Dichotomy

Operating Point can emerge as a **new Trans-disciplinary Reality Level**, based on **an irreducible complementary ideal asymptotic dichotomy:** Two Complementary Irreducible Coupled Computational Subsystems.



Natural Living Organism Resilience and Antifragility

Canadian ecologist **Crawford Stanley (Buzz) Holling** (1930-) has introduced important ideas in the application of ecology and evolution, including **resilience**, **adaptive management**, **the adaptive cycle,** and **panarchy**.

Panarchy is a conceptual term first coined by the Belgian philosopher, economist, and botanist **Paul Emile de Puydt** (1810–1891) in **1860**, referring to **a specific form of governance** (Panarchy) that would encompass (pan-) all others.(de Puydt, 1860) Here, "**Panarchy**" refers to the framework for conceptualizing **the type of coupled human-environment systems** described in **Gunderson & Holling** (2002) and more briefly, with some changes, in **Walker et al.** (2006). This framework may be divided into two parts, as "the resilience conceptual framework" and "the adaptive cycle metaphor."(Gotts, 2007)

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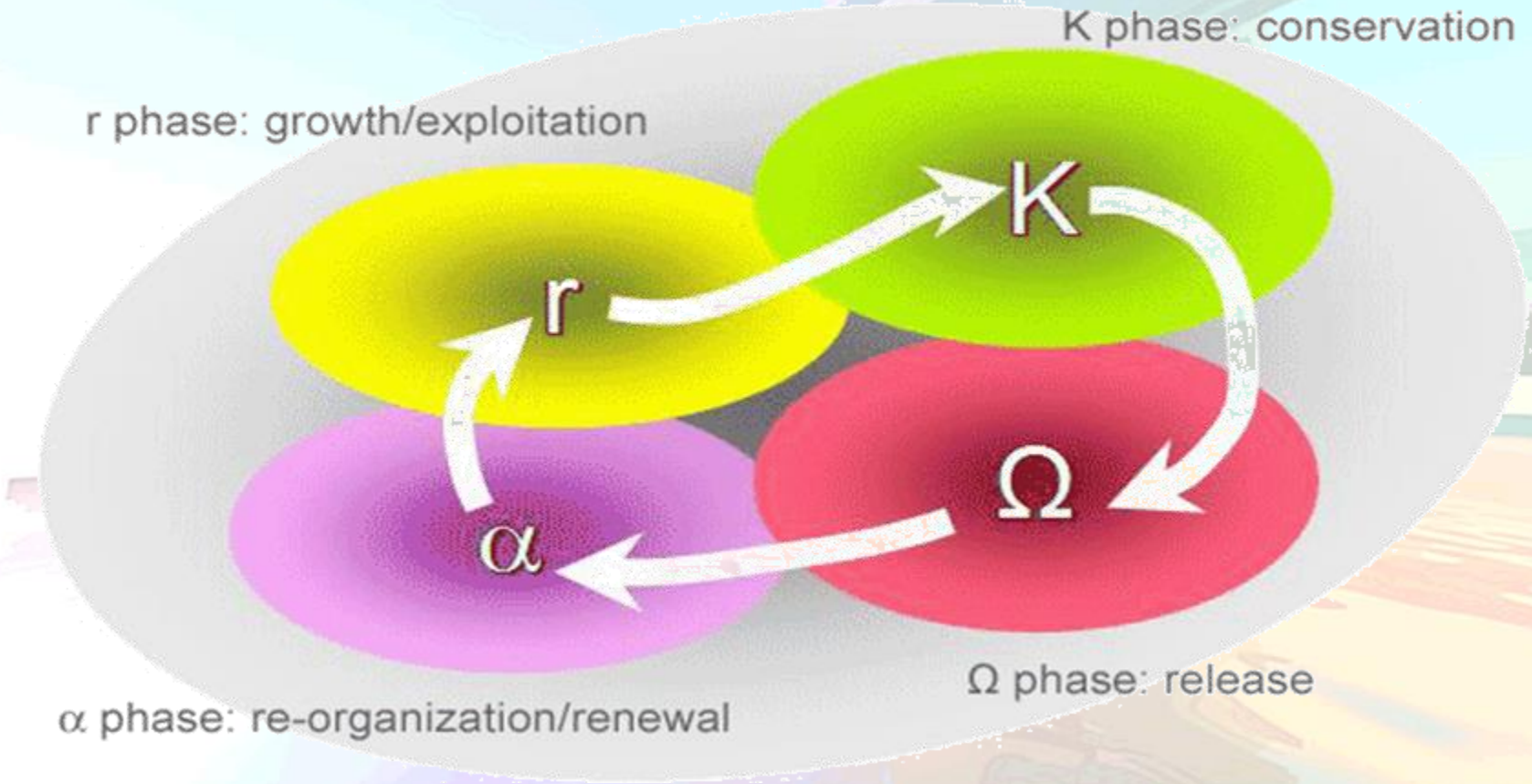
Environment Interface According to The Adaptive Cycle Metaphor

Holling and Gotts (2002, 2007)



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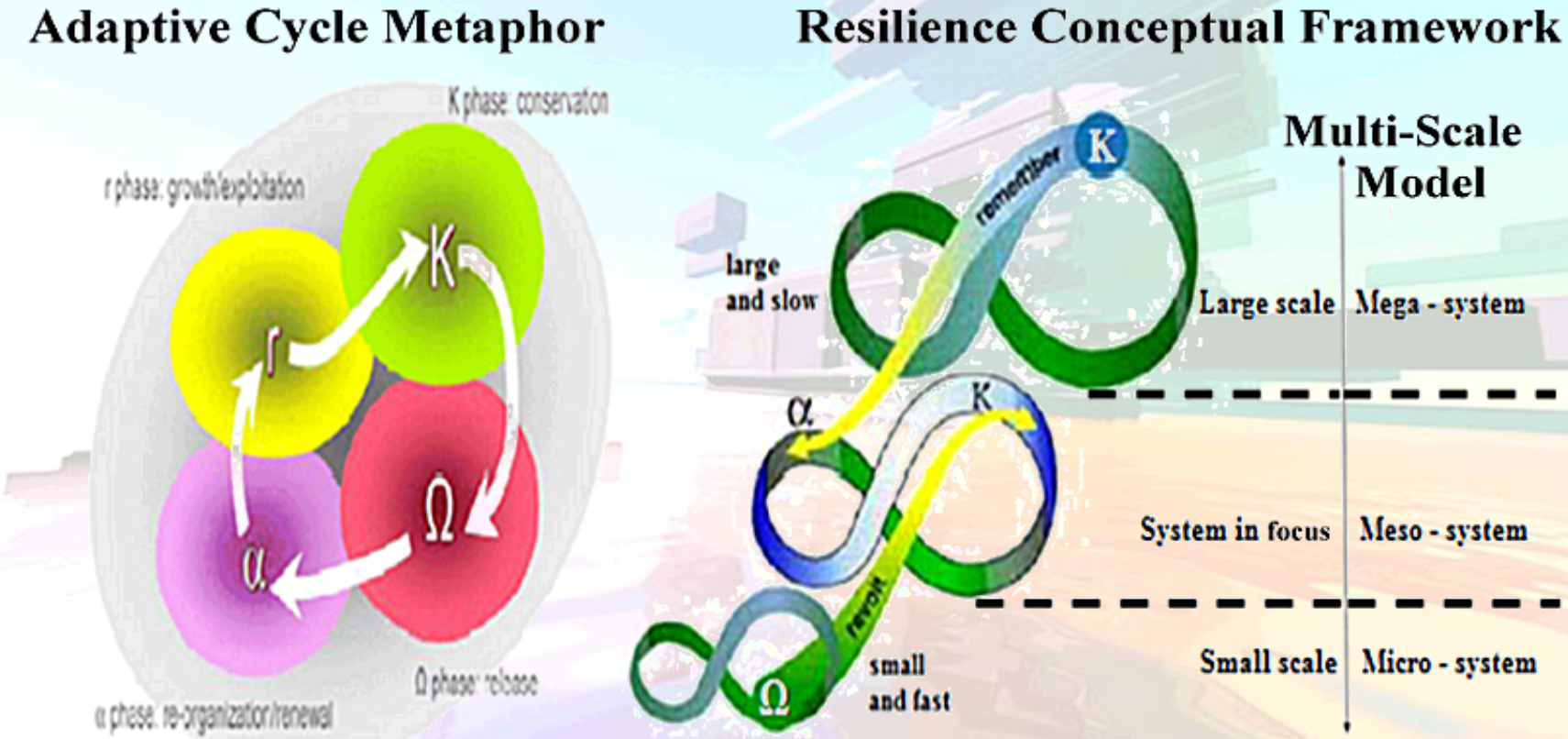
System Resilience from Multi-Scale Modeling

Gunderson & Holling and Walker (2002, 2006)



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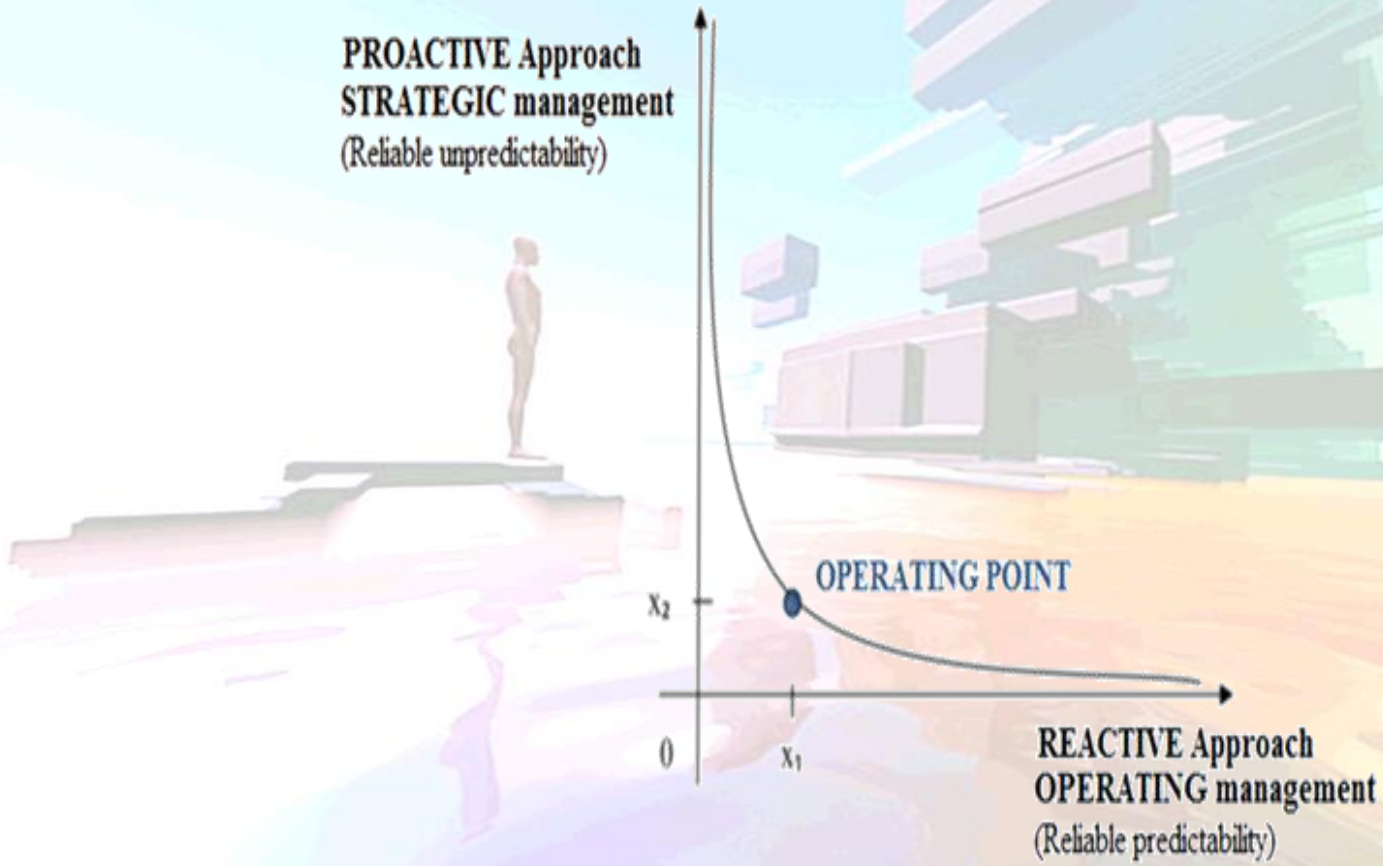
Two Irreducible Subsystems based on Ideal Asymptotic Dichotomy



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Operating Point can emerge as a **new Trans-disciplinary Reality Level**, based on **an irreducible complementary ideal asymptotic conceptual dichotomy: Reliable Predictability vs. Unreliable predictability**.

For **OPERATING Management (REACTIVE Approach) Subsystem**, we can choose from different alternatives offered by literature, like Deming's PDCA Cycle,(Taiichi Ohno, 2012) Discovery-Driven Planning,(Gunther McGrath & MacMillan, 1995), etc…

For **STRATEGIC Management (Proactive Approach) Subsystem,** we can choose from different alternatives offered by literature, like Boyd OODA Cycle,(Boyd, 1987; Osinga, 2006) Theory-Focused Planning, (Govindarajan & Trimble, 2004), etc…

To get a specific example for this presentation, as **OPERATING Management (REACTIVE Approach) Subsystem**, we choose **Deming PDCA Cycle**, and as **STRATEGIC Management (Proactive Approach) Subsystem,** we use **Boyd's OODA Cycle.**

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Two Irreducible Subsystems based on Ideal Asymptotic Dichotomy

Environment Interface Planning:

Holling's Cycle (r – K – Omega - Alpha).

Operational Management Planning:

Deming's Cycle (P – D – C - A).

Strategic Management Planning:

Boyd's Cycle (O – O – D - A).

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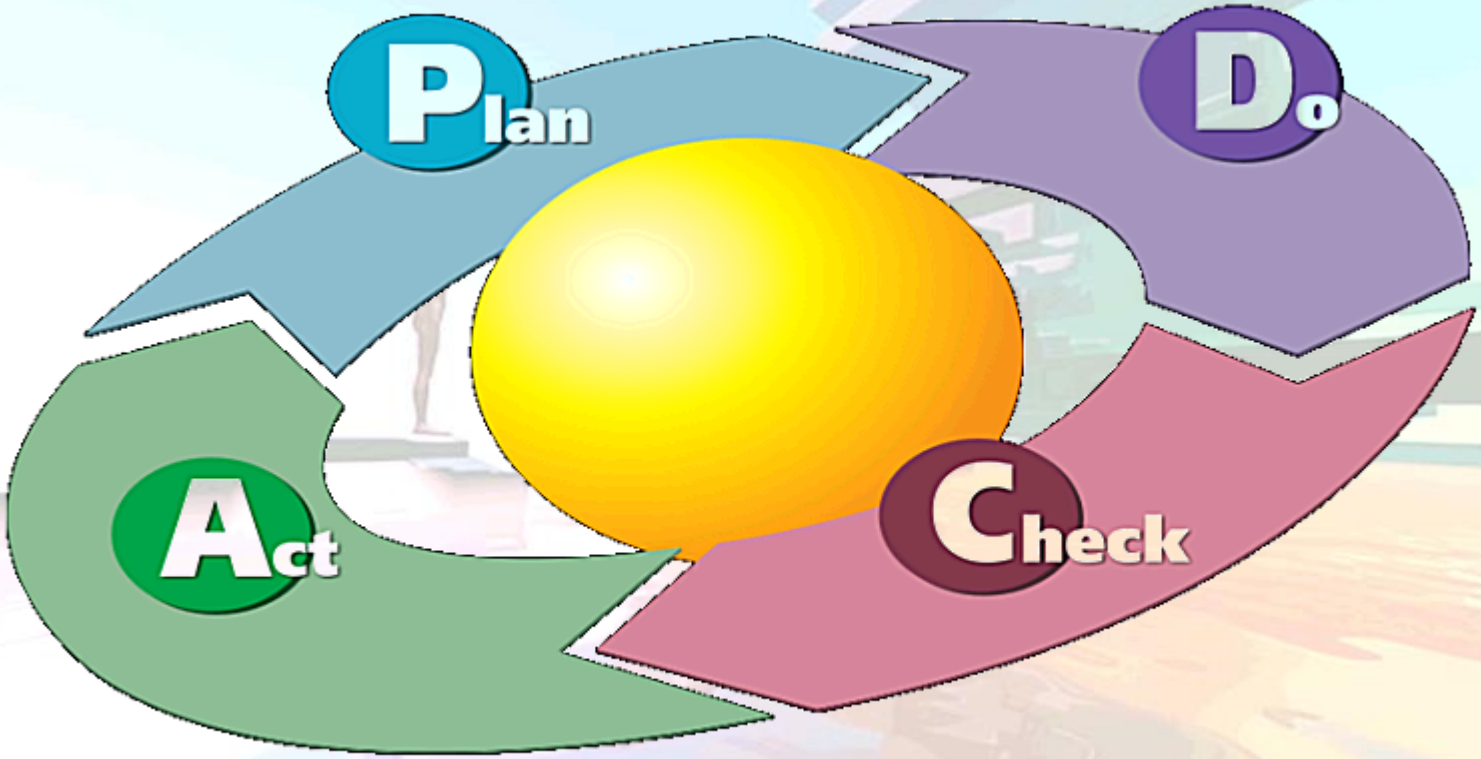
Operational Management Planning (Deming's Cycle)



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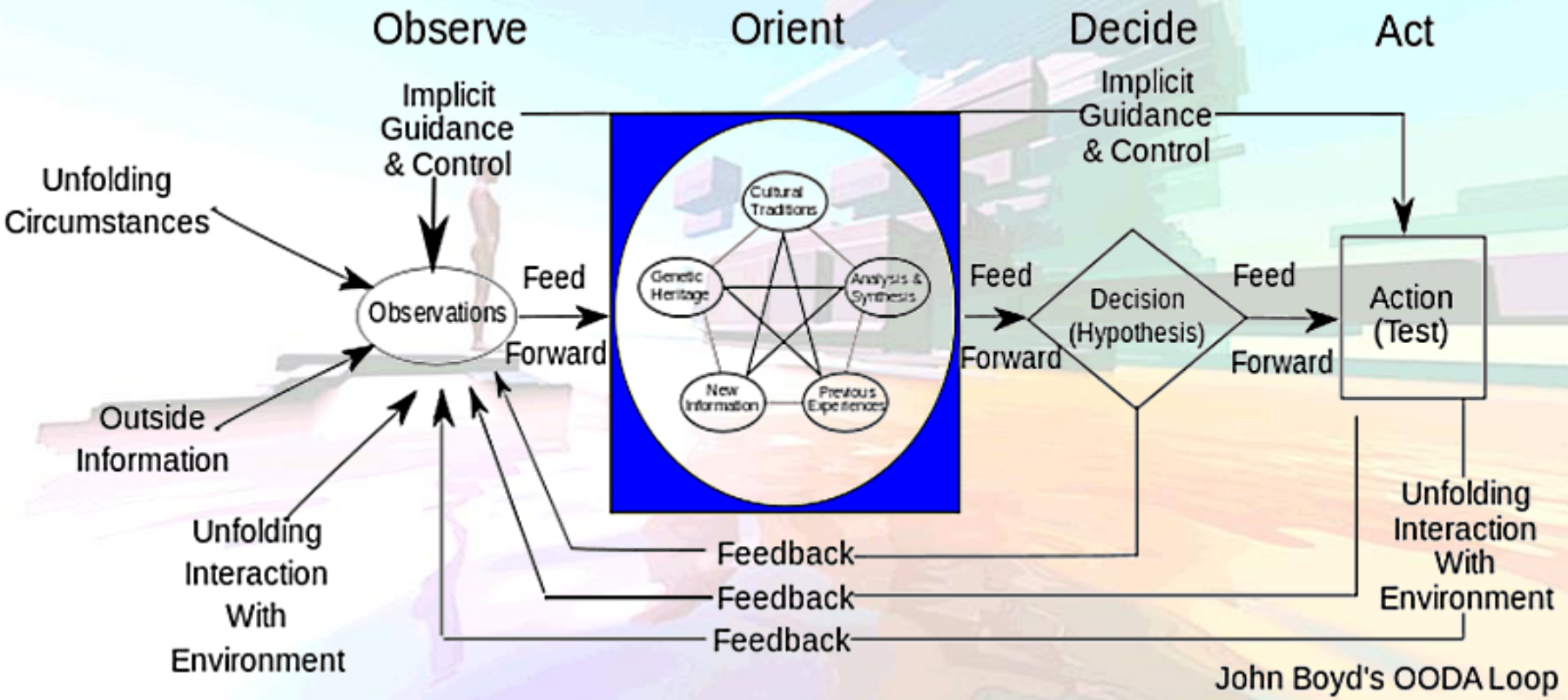
Strategic Management Planning (Boyd's Cycle)



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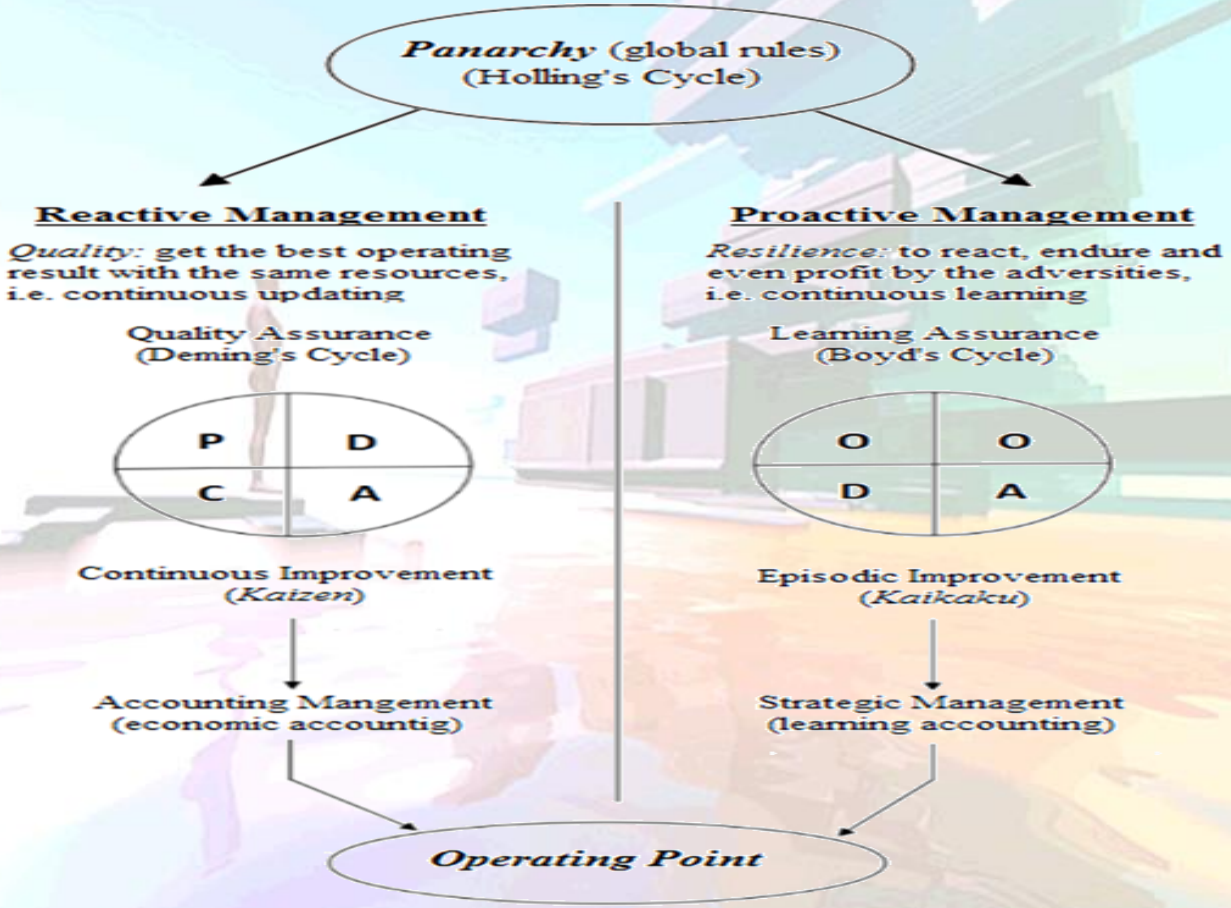
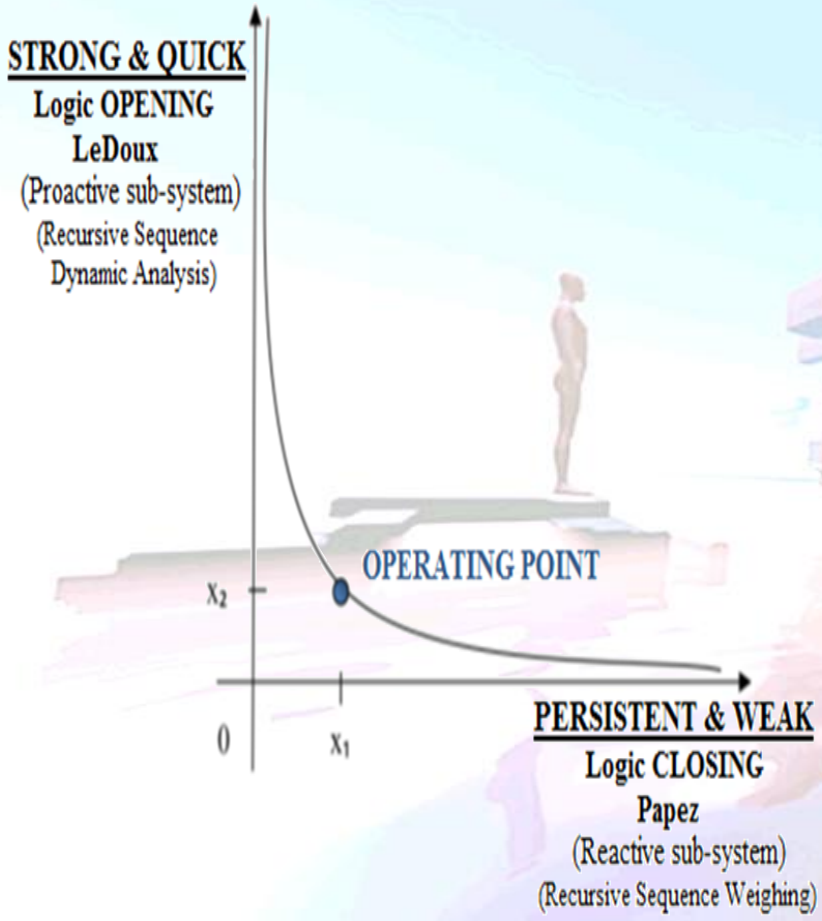
Final Antifragile Natural Framework



Emergent Transdisciplinary Reality Level



- ✓ **Emotional Intelligence (EI) and Emotional Creativity (EC)** coexist at the same time with **Rational Thinking**, sharing the same input environment information.
- ✓ Operating point as a trans-disciplinary reality level can emerge from two complementary irreducible, asymptotic ideal coupled concepts.
- ✓ To behave realistically, system must guarantee both Logical Aperture (to get EI and EC, to survive and grow) and Logical Closure (to get Rational Thinking, to learn and prosper), **both fed by environmental "noise"** (better… from what human beings call "noise").

(R.A. Fiorini, 2014)

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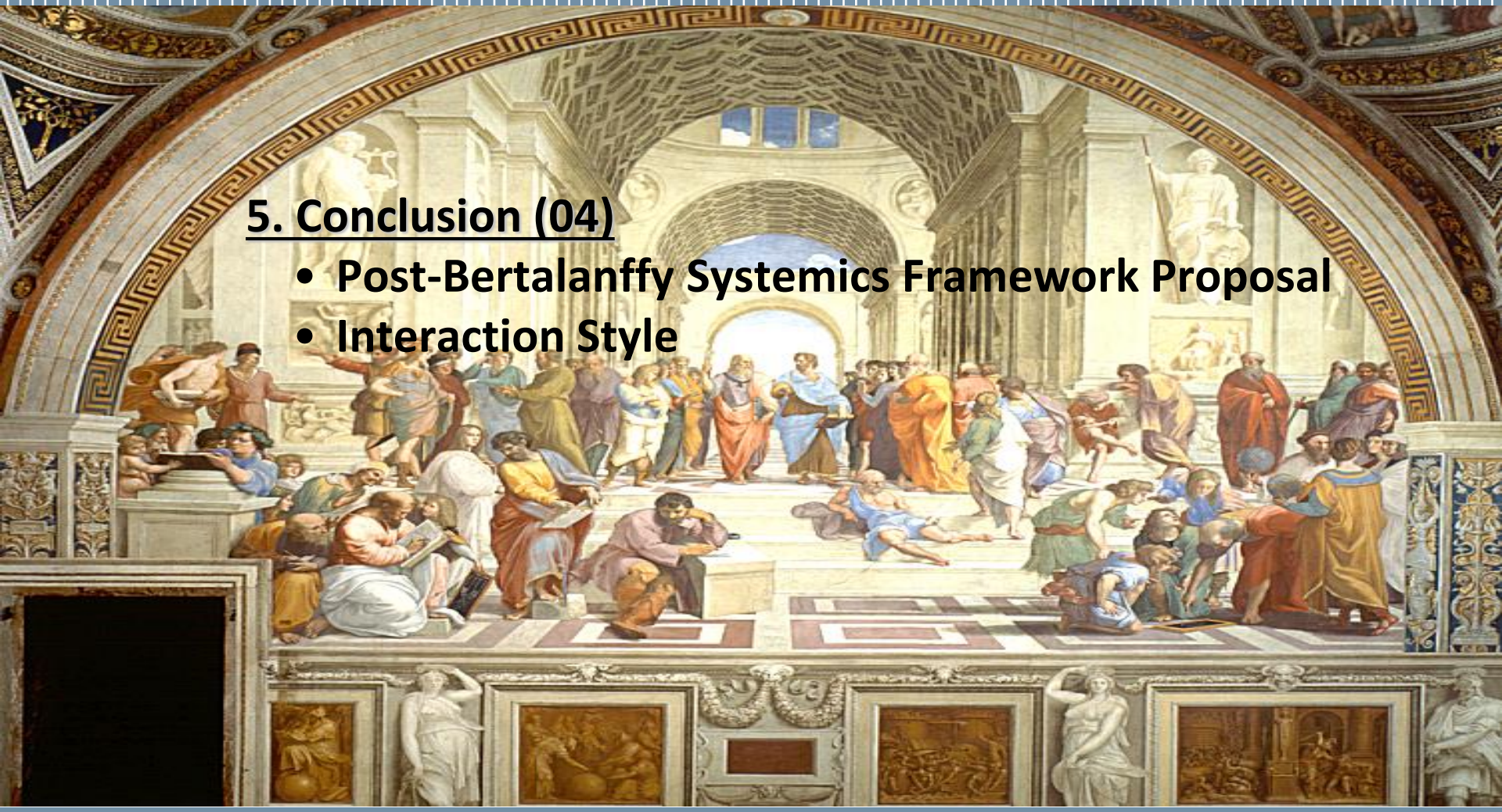


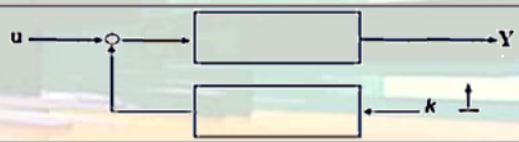
5. Conclusion (04)

- Post-Bertalanffy Systemics Framework Proposal
- Interaction Style

Post-Bertalanffy Systemics Framework Proposal

- **ZERO (Clausius):** Ideal, closed system, **totally isolated open-loop system**.
- **ONE (Wiener):** "**Self-steering**" is assumed to be **isolated from the act of observation** and negative feedback functions as part of a mechanical process to maintain homeostasis.
- **TWO (von Foerster):** The process of "self-steering" is now understood **to be affected by observer/s**, but the related mathematical modeling is insufficiently complex to encourage new values emerge. Nevertheless, it is understood that **Positive and Negative Feedback can lead to morphogenesis intuitively**.
- **THREE (Bateson, Beer, Ashby):** The process is understood as an interaction that can affect/be affected by **many observers**, but it does not address what this means for the "social" response-ability of the single participant observer. **Articulated values emerge**.
- **FOUR (Rosen):** Multiple realities emerge by the freedom of choice of the **creative observer** that determines the outcome for both the system and the observer. This puts demands on the self-awareness of the observer, and **valued response-ability for/in action.**

Post-Bertalanffy Systemics Framework Proposal

BIOMEDICAL CYBERNETIC ORDER	INTERACTION STYLE	GRAPHIC SYMBOL
Zero	Pure Spectator	
First	Ergodic Observer	
Second	Pulsed Egocentric Interactor	
Third	Iterated Egocentric Interactor	
Fourth	Recursive Interactor	

This **new awareness** can guide any quantum leap to more convenient future **post-human cybernetics approaches** in science and technology.

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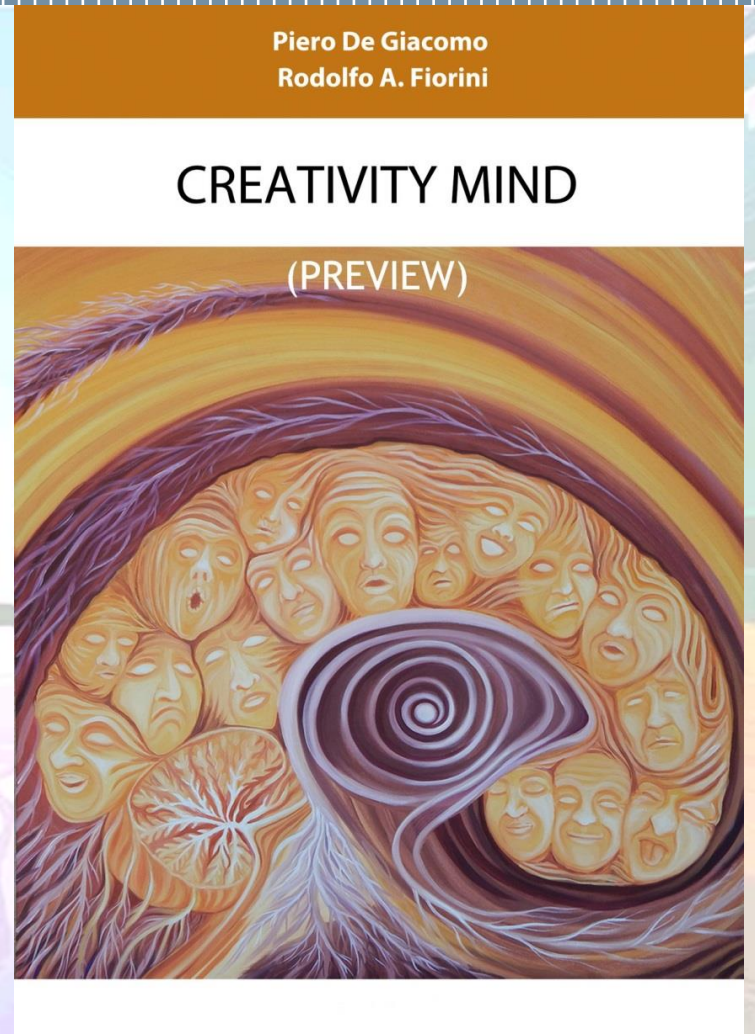

Neuralizer Work In Progress

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