

**2<sup>nd</sup> Intl. Conference  
on Future Education**



# **Transdisciplinary Education, Anticipation and Complexity**

From “Either/Or” to “Both/And” Thinking

**Rodolfo A. Fiorini**

Politecnico di Milano University, IT

# From “Either/Or” to “Both/And” Thinking

**Spacetime** (ST) invariant physical quantities can be related to the variables used by a specific interacting observer to get a representation and an interpretation of the world within which a human being is immersed.

Usually by classic operative interpretation, the original ST (**a transdisciplinary concept**), is split into two separated additive subcomponents “space” and “time”. From them we get our narrative and technical representations.

**This constrained operational splitting** may represent an advantage by a formal (rational) representation perspective (i.e. ease of representation and understanding), but its major drawback is **an original information precision loss**, if the observer is unaware of or unable to compensate for it partially.

SPACE	SIMPLE UNFOLDED LINEAR	COMPLEX FOLDED NESTED
TIME		
SIMPLE UNFOLDED LINEAR	OVERVIEW	TIMELINE
COMPLEX FOLDED NESTED	SNAPSHOT	

# From “Either/Or” to “Both/And” Thinking

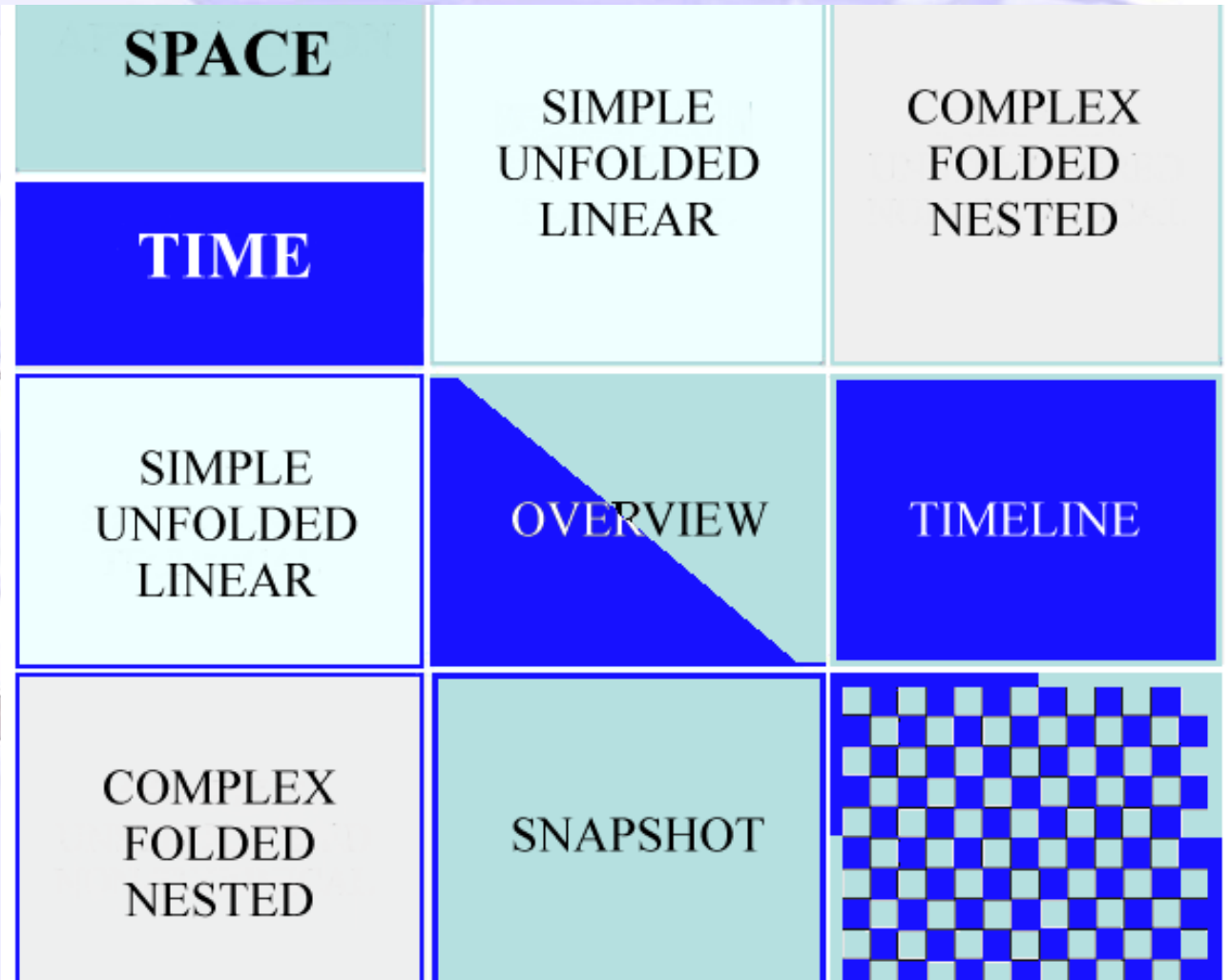
The term "**Timeline**" (first quadrant, top right) is considered the combination of a major linear time representation framed by folded minor space representation.

The term "**Overview**" (second quadrant, top left) is interpreted as the combined representation of major linear space and major linear time representations, with minor complementary folded time and space components.

The term "**Snapshot**" (third quadrant, bottom left) can be assumed as the combination of a major linear space representation framed by minor folded time representation.

**The forth quadrant** (bottom right) represents the combination of major folded space and time components, framed by the combination of minor linear space and time components.

**Usually human beings capture this deep information content at subconscious level.**





# From “Either/Or” to “Both/And” Thinking

In modern times, specialization has overtaken broader fields of knowledge and multidisciplinary research. Our past knowledge is organized in “silos”:

good for grain, not for brain.

The mental world we live in today is infinitely divided into categories, subjects, disciplines, topics, and their more and more specialized subdivisions.

As a result American universities now offer more than 1000 specialized subdisciplines, and European ones are following them accordingly.



# From “Either/Or” to “Both/And” Thinking

Forcing societies to fit in a box without understanding deep reasons may lead to serious consequences like those we witness in many world affairs today.

**Interdisciplinarity** and **transdisciplinarity** are really the ways society, together with scientists and scholars, must move on.

**Interdisciplinary** consists, for instance, of a **disciplinary reformulation of problems**, like from theoretical to practical representations, from mechanical to electromagnetic, from biological to chemical, from clinical research to healthcare, etc., and **transdisciplinary** is related to the **study of such reformulations and their properties**.





# From “Either/Or” to “Both/And” Thinking

“higher stage succeeding interdisciplinary relationships . . . which would not only cover interactions or reciprocities between specialised research projects, but would place these relationships within a total system without any firm boundaries between disciplines” (**Jean Piaget**, 1972, The epistemology of interdisciplinary relationships, OECD, p. 138).

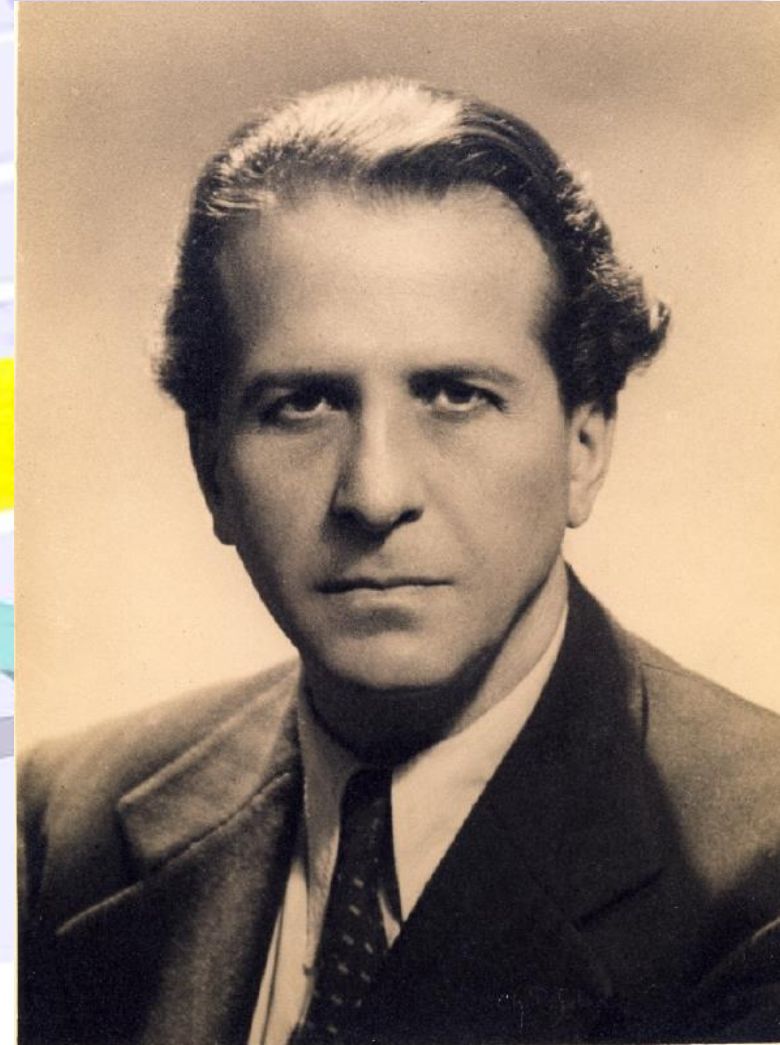


# From “Either/Or” to “Both/And” Thinking

History will credit **Stéphane Lupasco** (b.1900–d.1988) with having shown that **the logic of the included middle** is a true logic, formalizable and formalized, multivalent (with three values:  $A$ ,  $\neg A$  (non- $A$ ), and  $T$ ) and non-contradictory.

His philosophy, which takes quantum physics as its point of departure, has been marginalized by physicists and philosophers.

Curiously, on the other hand, it has had a powerful albeit underground influence among psychologists, sociologists, artists, and historians of religions.





# From “Either/Or” to “Both/And” Thinking

**Basarab Nicolescu** (b.1942-) means by the term **"transdisciplinary"** that which crosses all disciplines and finds itself between and beyond all disciplines. Therefore the **"transdisciplinarity"** is clearly not a new discipline. It is a **learning process**.

In this way, **the logic of the included middle** is not simply a metaphor, like some kind of arbitrary ornament for classical logic, which **would permit adventurous incursions into the domain of complexity**.

**The logic of the included middle is the privileged logic of complexity**, privileged in the sense that it allows us to cross and to navigate the different areas of knowledge in a coherent way, **by enabling a new kind of simplicity**.





# From “Either/Or” to “Both/And” Thinking

Emergent Transdisciplinary Reality Level

Exploring the wave nature of trapped light  
and taming photonic Schrödinger cats

LIGHT IS A

Wave!

(Ambigram by Douglas R. Hofstadter, 2008)

# From “Either/Or” to “Both/And” Thinking

## WORKING EXAMPLES

- ❑ (1924, Louis De Broglie) **All matter has wave properties.**
- ❑ (1890s, Adolf Erik Nordenskiöld, (1934, Stephan Riess), **Primary water .**
- ❑ (2013) **CICT** (Computational Information Conservation Theory).
- ❑ **Etc.....**

HOW?





# From “Either/Or” to “Both/And” Thinking

## All Matter Has Wave Properties

- ❑ In 2017, Rainer Weiss, Barry C. Barish and Kip S. Thorne, were awarded the Nobel Prize in Physics “for decisive contributions to the LIGO detector and the observation of gravitational waves”



Photo: Bryce  
Vickmark  
**Rainer  
Weiss**

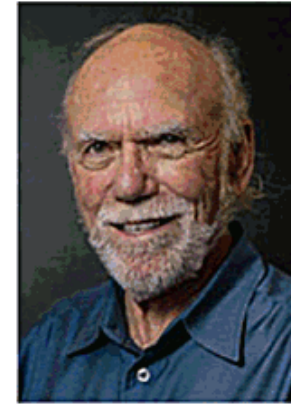


Photo: Caltech  
**Barry C.  
Barish**



Photo: Caltech  
Alumni  
Association  
**Kip S.  
Thorne**

# From “Either/Or” to “Both/And” Thinking Primary Water

- ❑ Oxygen and hydrogen combine under the electromechanical forces of the earth to form liquid water. Riess drilled 753 documented primary water wells on four continents. Projects now underway in Nigeria and Madagascar.



Stephan Riess with 1,900 gallon-a-minute well he drilled above bone-dry Simi Valley, California. Courtesy of The Riess Institute



# From “Either/Or” to “Both/And” Thinking

Etc.....

- ❑ Toolkits for transdisciplinary research.
- ❑ <https://i2insights.org/2017/07/25/toolkits-for-transdisciplinarity/>

**STRONG & QUICK**

Logic OPENING

LeDoux

(Proactive sub-system)

(Recursive Sequence  
Dynamic Analysis)

OPERATING POINT

**PERSISTENT & WEAK**

Logic CLOSING

Papez

(Reactive sub-system)

(Recursive Sequence Weighing)

# From “Either/Or” to “Both/And” Thinking

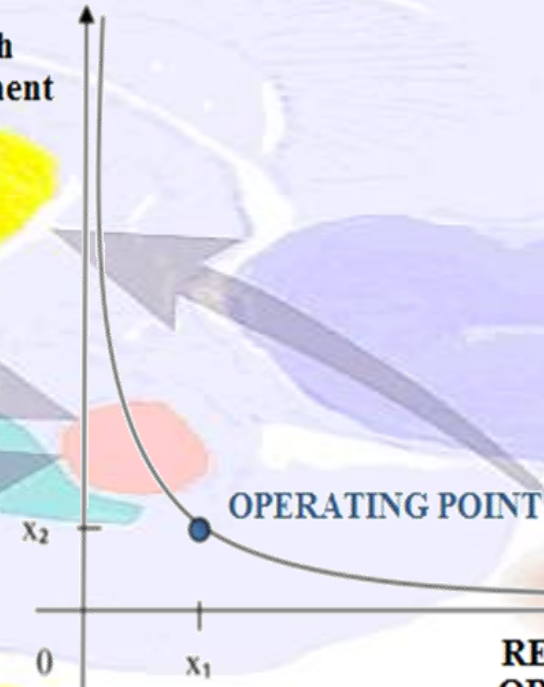
To provide **reliable anticipatory knowledge**, system must produce predictions ahead of the predicted phenomena as fast as possible. Then, they have to be verified by a reality level comparison, to be validated and accepted, and then to be remembered as learned reliable predictions.

This validation cycle (**emulation**) allows system tuning and adaptation to its environment automatically and continuously.

**Current traditional formal systems are unable to capture enough information to model natural system realistically.** They cannot capture, represent and describe real system emergent properties effectively.

**It is time for an Ontological Uncertainty Management (OUM) system upgrade.**

**PROACTIVE Approach**  
**STRATEGIC management**  
(Reliable unpredictability)



**REACTIVE Approach**  
**OPERATING management**  
(Reliable predictability)



From “Either/Or” to “Both/And” Thinking

