Projection of Sensitive Reality

into Cellular Topology

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Projection of Sensitive Reality into Cellular Topology

- *What we see and what is*
- *« Reality » and perception*
- *How can we do : starting from simple forms*
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- *Difficulty to feel N-parameter space*
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- *Construction of the system*
- *Adding interactions*
- *Not received interactions*
- *Tenfold and system representation*
- *Evolution of a system*
- *How to test a model ?*
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- *Conclusion*

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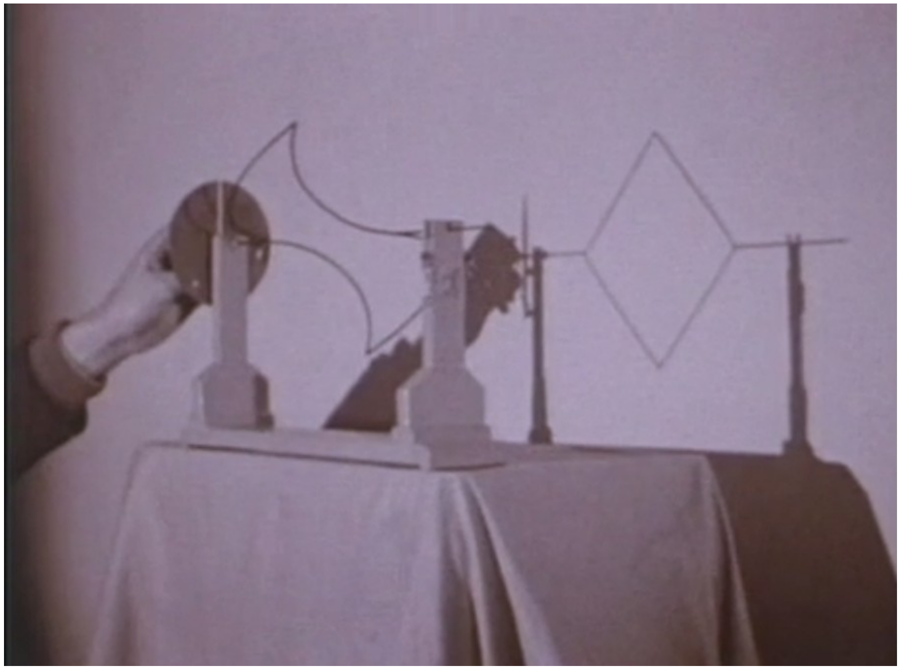

We turn the original form. We look at the projected one.

The sequence of transformation seen goes through known figure like a circle or a square. But these figures have various properties. Without seeing it, we don't have a natural thinking for the original form.

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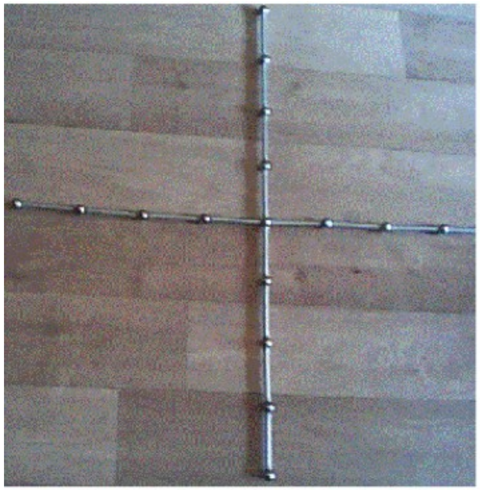

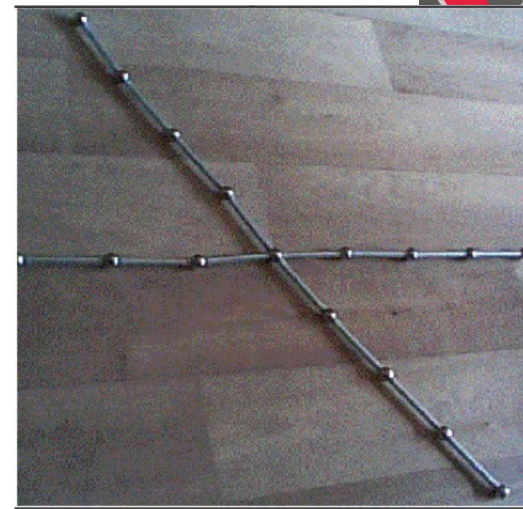

Based on past knowledge, known experience, we can through analogy and logic recognize 3D transformation.

But unknown situations can lead to similar perceptions.

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Construction of simple forms can be relatively better controlled Starting from points, we can create branches, closed paths, surfaces.

Geometrical element	Cellular denomination
Point	Node
Branche	Edge
Closed path	Mesh
Surface	Face

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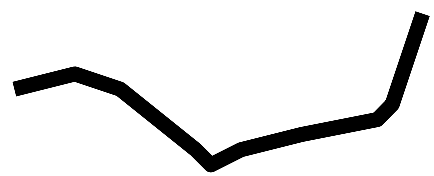
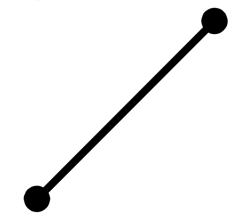
First step: form analogies

Real branch

geometrical one



symbolic edge



We identify major directions of freedom for flux. From and on these flux we can define laws associated with the real object. These laws can be detailed at various scales with properties linked on nodes, edges, meshes, faces. Connectivities give relations between these cellular elements.

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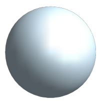
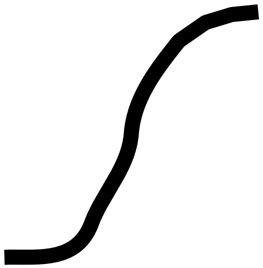
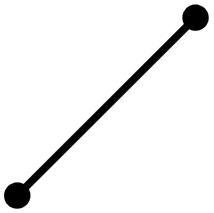


Elementary volume → local load, mass → node



Impose way of flux → input and output identification,
Branch identification → edge



With many branches I can make a tree, with many edges, I can make a network.

To a given level, more complex properties appear

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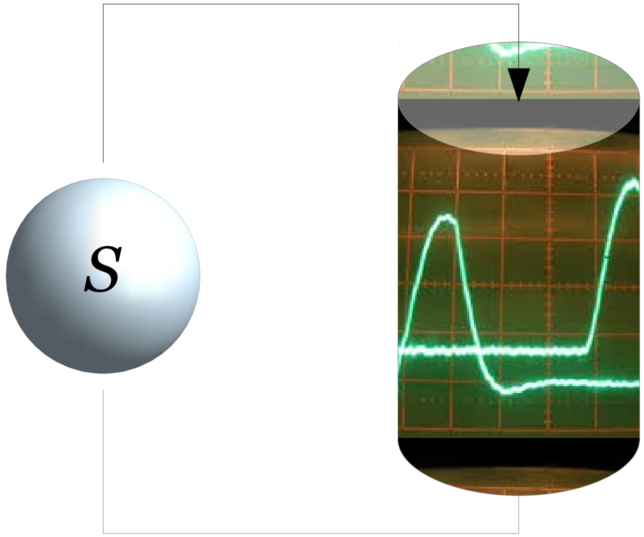
Flux measurement

Stimulus →



Object under test

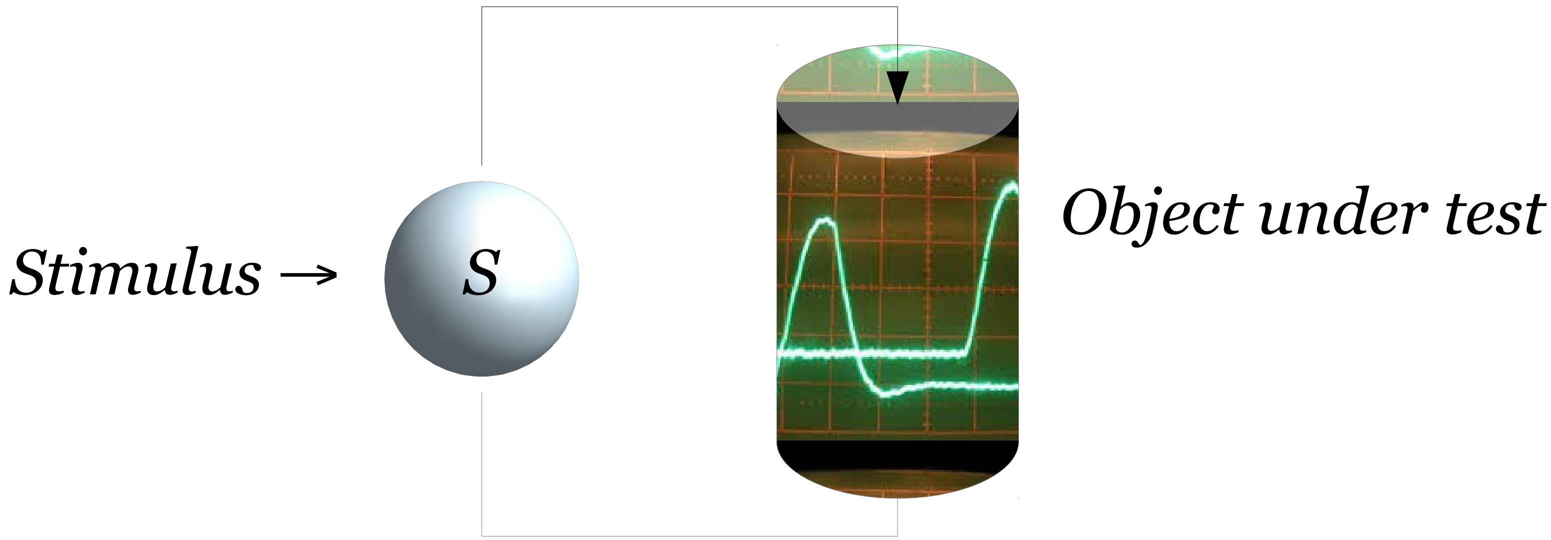
The measurement doesn't take into account all the parameters involved

Temperature

...

Humidity *pressure*

Flux measurement



A law is obtained from this measurement linking stimulus and flux:

$$S = L\left(f\ ;\ p_1,\ p_{2,} \ldots,\ p_N\right)$$

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A law is obtained from this measurement linking stimulus and flux:

$$S = L\left(f\ ;\ p_1,\ p_2, \ldots,\ p_N\right)$$

Many parameters p_i are not considered:

Reality → $S = L\left(f\ ;\ p_1,\ p_2, \ldots,\ p_N\right)$

Measurement → $S = L\left(f\ ;\ p_1,\ p_2, \ldots,\ p_Q\right),\quad Q < N$

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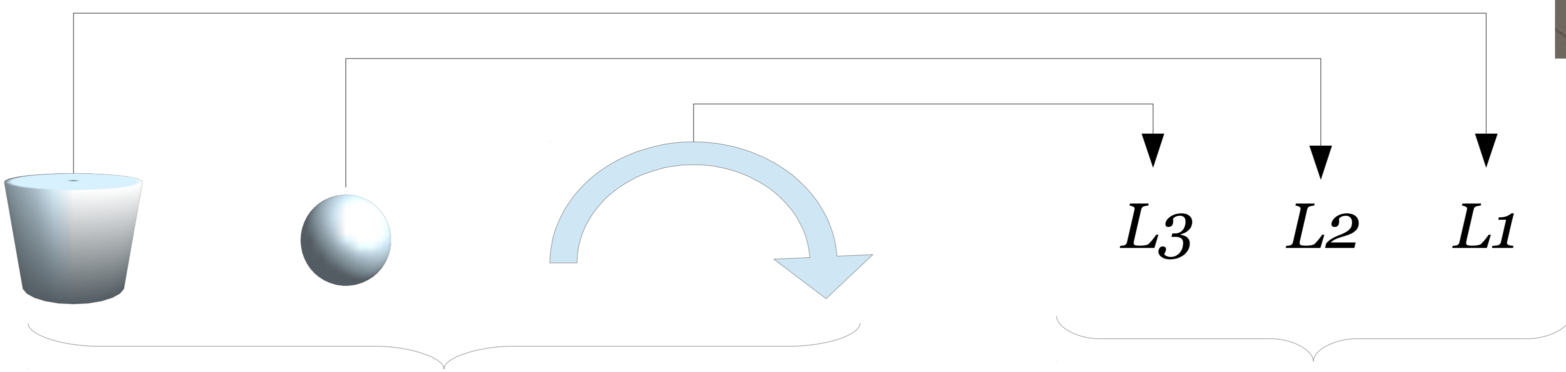

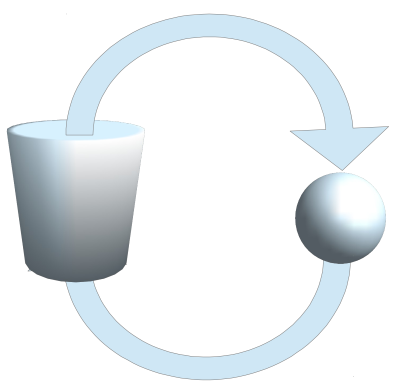

$$Z = \oplus_i L_i$$

$$Z = \begin{bmatrix} L_1 & 0 & 0 \\ 0 & L_2 & 0 \\ 0 & 0 & L_3 \end{bmatrix}$$

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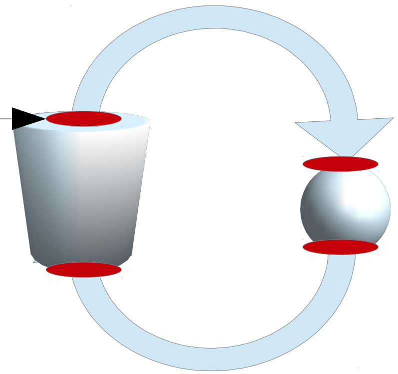

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Connectivity → Graph G construct from direct sum Z

: transformation T(G) applied to Z

$$\left\{ \begin{array}{l} T(G)\cdot Z \\ \\ Z = L_1 + 2L_2 + L_3 \end{array} \right.$$

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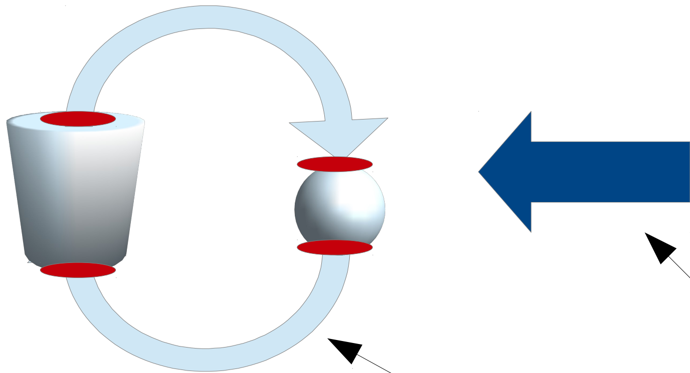

External or internal interactions created with the system

$$S = L\left(f\ ;\ \underbrace{p_1, p_2, \dots,}\ \underbrace{p_{17}, p_{18}, \dots}\right)$$

$$P = T(G) \cdot Z + I$$

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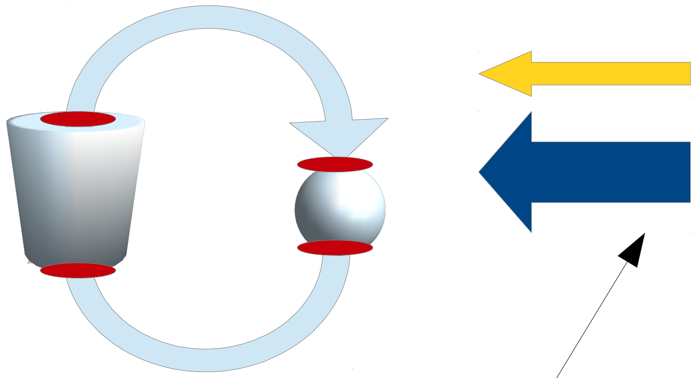

Influent but unknown parameters

$$S=L\left(f\,;p_1,p_2,\dots,p_{17},p_{18},\dots\right)\neq S_{\mathrm{real}}=L\left(f\,;p_1,p_2,\dots,p_{17},p_{18},\dots,q_{37},q_{38},\dots\right)$$

$$P=T(G)\cdot Z+I\neq P'=T(G)+I'$$

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TENFOLD: from "ten" → tensors & "fold" → multilayers structure

The objective is to group mathematical objects used to model a system.
It includes:

- *The tensor of the system properties*
- *Its topological definition*
- *Its sources of energy*

$$\breve{u} : (T , P , W)$$

Each element of a tenfold can be transformed by an element of Another fundamental group: the transformers

$$t : (\Lambda , C^T C , D^T) \qquad \breve{v} = t \cdot \breve{u} = (\Lambda T , C^T P C , D^T W)$$

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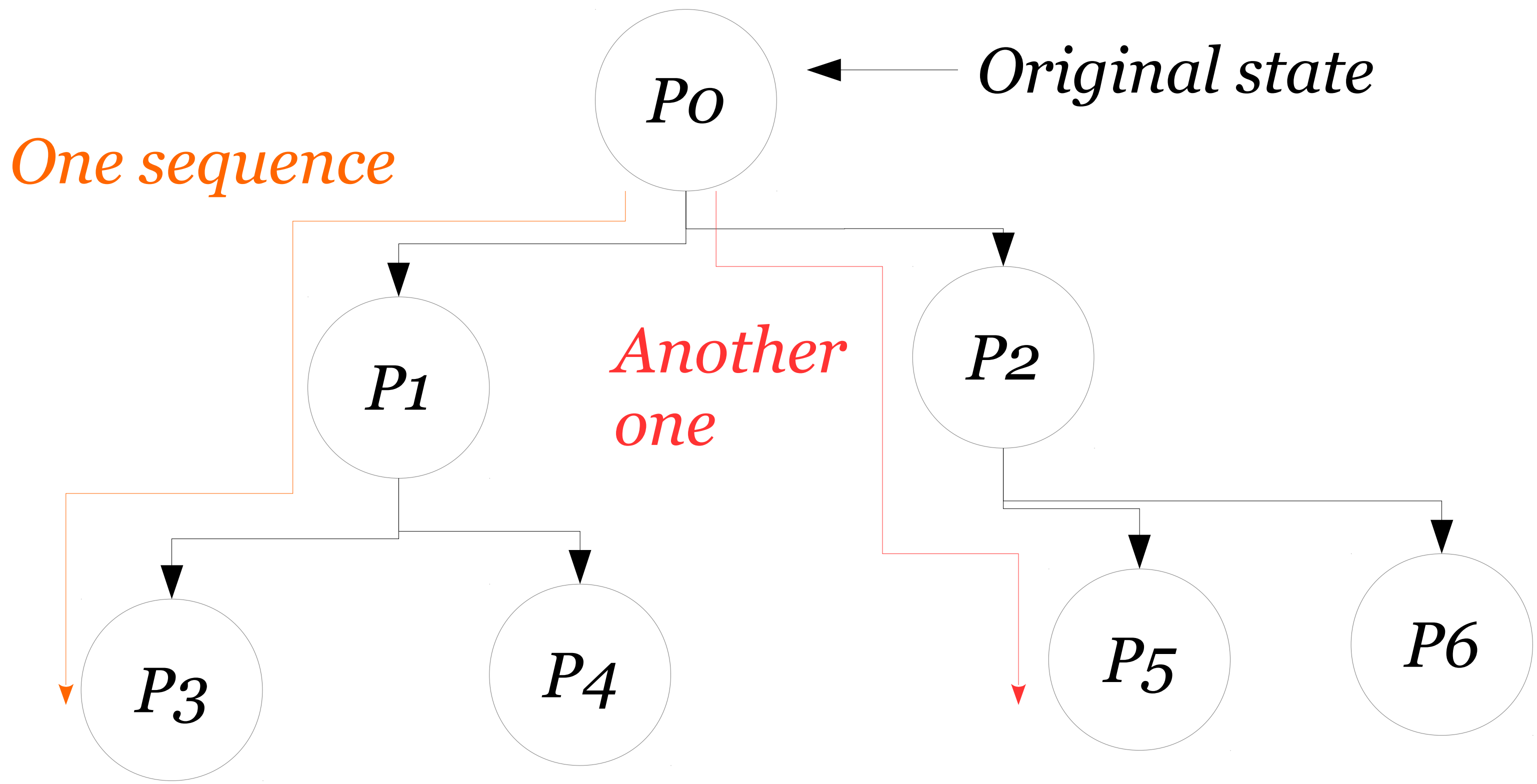
A system evolution can be seen like various sequences of transformers applied on an original tenfold of properties P_o.



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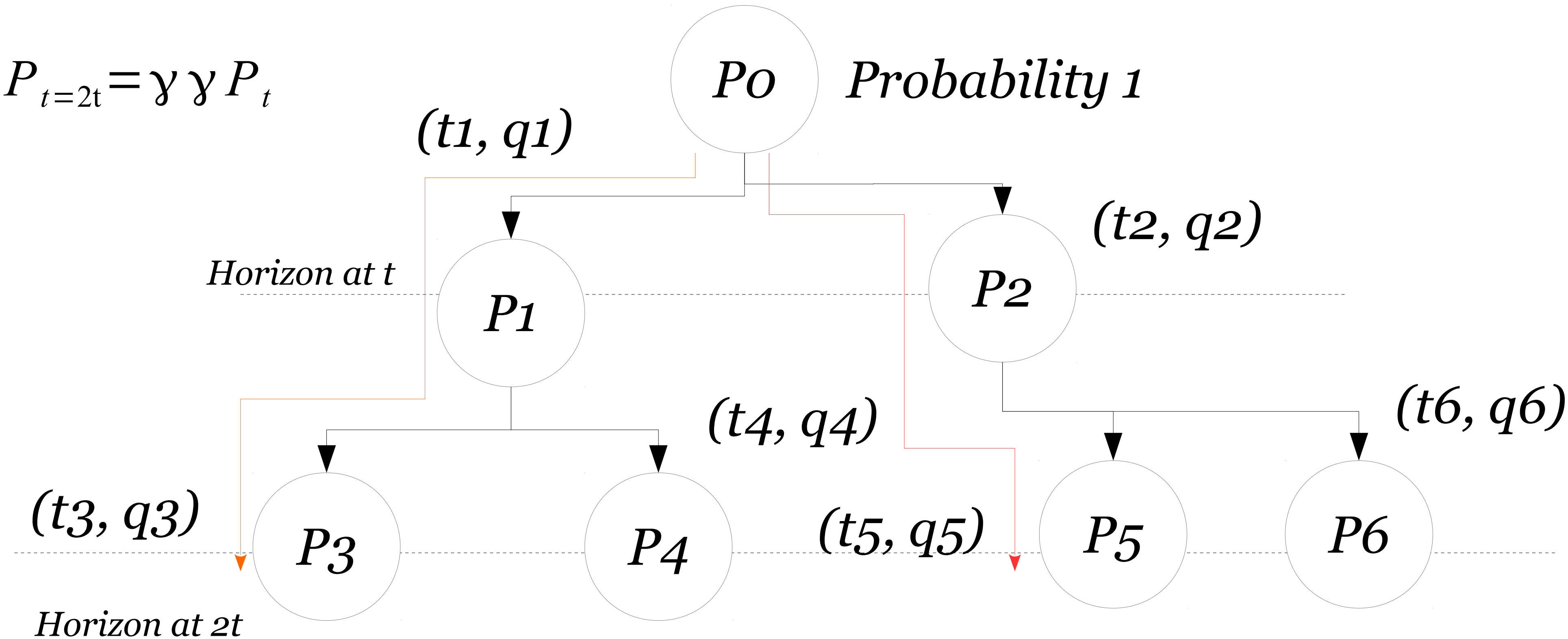
To translate the evolution of the system, a special object called a "gamma matrix" is applied on the tenfold. It includes transformers, but also probabilities attached to each kind of transformation.

$$P_{t=2t} = \gamma \gamma P_t$$



$$P_{i+1} = \gamma P_i = t_{i+1,i} \cdot \breve{u}(P_i), q_{i+1,i} \operatorname{Proba}(P_i)$$

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The validation of a model consists in making the comparison between the results given by the model and the measurements made on the real object.

In many situations, this comparison can lead to acceptable models, i.e. that the difference between both observations are sufficiently low to accept the model as a good simulation of reality.

But this doesn't demonstrate that the model is complete. In another context, some unknown parameters could modify the response of the system and show that the model is not correct in this context.

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The evolution acts on both the intrinsic properties and interactions. We suppose that self properties are quite well defined. Diversion may in this case comes from the interactions only.

$$\gamma P \rightarrow t_\beta^{\ \mu} T_\mu^{\ \alpha} Z_{\alpha\nu} + t_\beta^{\ \mu} I_{\mu\nu}$$

$$\left| \bar{\omega}_I - t_\beta^{\ \mu} I_{\mu\nu} f^\beta f^\nu \right|$$

$$\bar{\omega}_I(N) - t_a^{\ b} t_b^{\ c} t_c^{\ d} \cdots t_\beta^{\ \mu} I_{\mu\nu} f^a f^\nu = A$$

A diversion even weak with time is a witness of a masked parameter involved in the system evolution ("thin effects" & emergencies)

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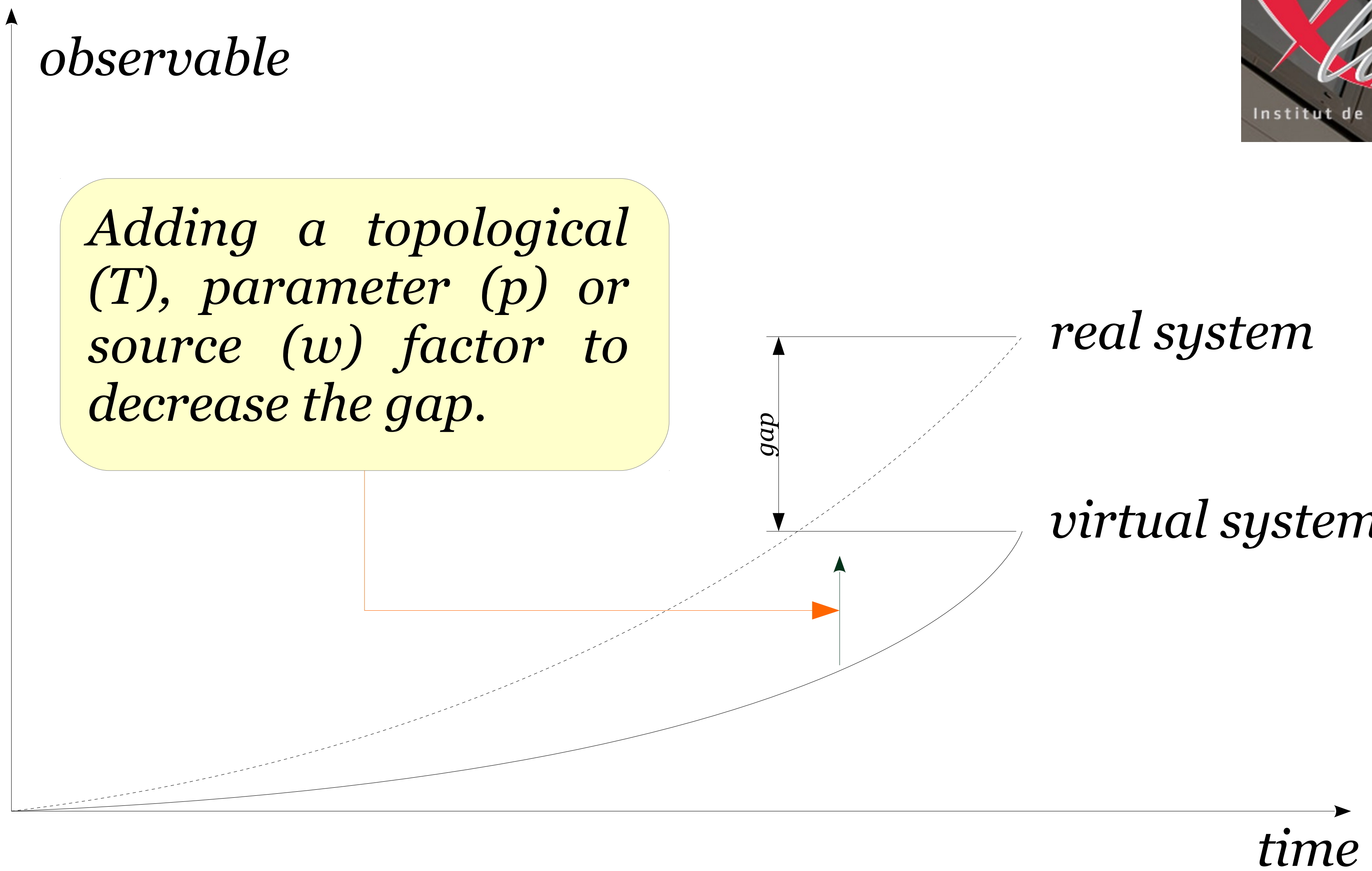
Adding a topological (T), parameter (p) or source (w) factor to decrease the gap.



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The world we perceive is in general very poor compare to the real one masked to our perception. This stills true in modelling exercise. Hypothesis on the parameters involved are often simples and can lead to diversion, but after long time of model life. The diversion of behaviour can be seen as a emergence for the system as it's an unexpected result in its evolution. In all case, it is sure that this behaviour comes principally from construction of the system and doesn't belong to the primitive elements associated with the cellular components.

This can be considered as a witness for systemic in our hypothesis of attachment with the only interaction tensor between the system and its context.

Various facts have confirm this kind of behaviour, we can think for example of the dioxin effect on male fertility.