

# Cognitive-Constructivism, Art & Ontology: Living Forms (Roses) of the Active Logos

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Presented at:



FórumMuBE-2014 (Sculpture Museum), June 02, São Paulo.

<http://www.ime.usp.br/~jstern/miscellanea/jmsslide/mubes.pdf>

# This Presentation

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Living Forms (Roses) of the Active Logos
- II - Autonomus or Autopoietic Systems
- III - Objects as Tokens for Eigen-Solutions
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# Cognitive Constructivism - Autonomous System

- Autonomous (Living) or Autopoietic System:  
*A system organized as a network of processes of production of components that, through their interactions & transformations, recursively regenerate the same production network and its constituent components. See Heniz von Foerster (2001,2003), Humberto Maturana and Francisco Varela (1980).*
- Example of concrete or abstract autonomous system interacting with its environment:
  - Bacterium in its culture medium;
  - Human individual living in his or her social environment;
  - Commercial organization in its field of business;
  - Scientific discipline and its field of study, that is, the discipline's standard language, theories, empirical means and methods, experimental tools and equipment, etc., that have been developed for the continuous research of its area of interest.

# Living, Autopoietic and Inferential Systems

- Ex1: Football, passive object that interacts with a player according to FIFA's Law 2 of the Game: Spherical symmetry,  $26\pm 1$ in size,  $15\pm 1$ oz weight, 0.6-1.1atm inflation pressure, etc; characteristics determining the exact form of a *stable behavior*.
- Ex2: Virus (RNA), active autocatalytic objects, but not *alive*.
- Ex3: Bacterium (DNA), strange-loop that recursively renews its molecular components during its lifetime, Bertalanffy (1969).
- Autopoietic systems are organized (defined as a unity) as a network of processes of production (transform., destruction) of components that, through their interactions and transformations, continuously regenerate and realize the same network.
- This circular organization implies predictions: Interactions that took place once will take place again... Every interaction is a particular interaction, but every prediction is a prediction of a class of interactions. This makes living systems inferential systems, and their domain of interactions a cognitive domain. Maturana, Varela (1980, p.10, 78-79, 84).

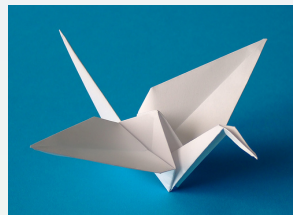
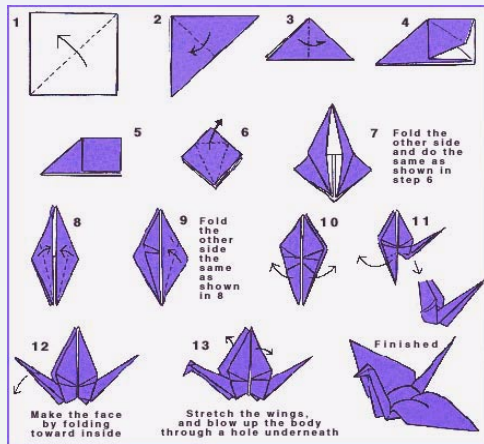
# Objects are Tokens for Eigen-Solutions

- Heinz von Foerster's key metaphor:
  - *Objects are Tokens for Eigen-Solutions.*
- Eigen-solutions emerge as invariant entities, i.e., operational eigen- invariant- equilibrium- fixed- ... -solutions -behaviors -states -points, for an autonomous system interacting with its environment (footsteps of Felix Klein, Emmy Nöther, etc.).
- Objects, and the names (words) we use to call (label) them, stand for and point at such invariant entities.
- Words can be articulated in language. The articulation rules defined for a given language, its grammar and semantics, only make the language useful if they somehow correspond to the composition rules for the objects the words stand for.
- Ontologies are carefully controlled languages used in the practice of science. They are developed as tools for procedure specification, thinking and communication.

# Eigen-Solution - Essential Attributes - Ontology

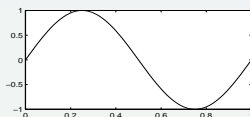
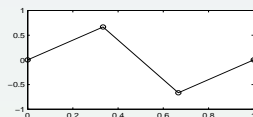
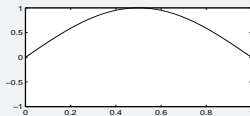
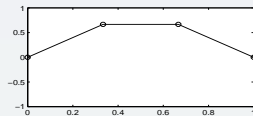
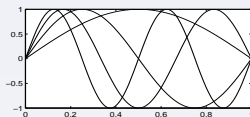
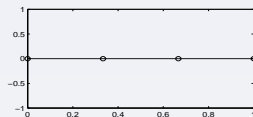
- Eigen-solutions are characterized by four essential attributes, namely - *precision, stability, separability and composability*.
- Precise  $\sim$  discrete, lower-dimensional, sharp, singular...
- Essential Attributes may lead to the concept of basis, as in: Linear algebra; Fourier or Wavelet analysis; Continuous or discrete group theory (generators); Matroid structures; etc.
- Fundamental metaphor in general (informal) contexts.
- Represented in statistical models by *sharp hypotheses*, demanding well-adapted methods of statistical inference.
- ZPP - Zero Probability Paradox - Possible  $H \mid Pr(H) = 0$  !
- $ev(H \mid X)$  - The Bayesian *epistemic value* or significance measure of hypothesis  $H$  given the observed data  $X$ . ✓
- Successful (statistical) testing of such sharp hypotheses implies an evaluation of “objectivity” or a verification of “existence” for a corresponding set of objects in a pertinent scientific ontology !!! = ! + ✓

# Eigen-Solutions - Essential Properties



Origami folding instructions for a Crane (Tsuru). Richard Dawkins: What happens when we play Chinese whispers game with both cranes? Why? Folds are: Exact, Stable, Separable and Composable! Biology: Self-assembly by tissue foldings, organic morphogenesis.

# Eigen-Solutions - Essential Properties



Eigen-Solutions of continuous and discrete vibrating chords. Musical notes are precise, stable, separable and composable; the “atoms” or “building blocks” for all western musical systems. Sumerian musical notation in diatonic scale precedes functional analysis by 40 centuries!



# What is the Ontological Status of Fictional Objects?

- *Ornithorhynchus anatinus*, the duck-billed Platypus:
  - Real object (belongs to a standard ontology) of biology with an atypical inheritance structure or incompatible characteristics.
  - Mammal & oviparous / teats: Mutually (ex / in)clusive.
- Chinese Taxidermist: Fictional character used to disqualify early platypus examples. When/how did they become (un)real?



- Diachronic ontological alignments: Following reification (birth) and de-reification (death) processes in the evolution of scientific and fictional ontologies.

# What is the Ontological Status of These Objects?

- Rhino, Narwhal and and real Tusk (Uni-Horn):



- Pegasus, Unicorn and more real objects:



# How to Build Valid Fictional Ontologies?

- How are the essential characteristics of Invariance and Stability manifested in fictional or mythological objects?
- Tools for automatic identification of objects in a corpus?
- Tools for identifying invariant predicates / semantic relations?
- Tools for classifying (ex. fictional / non-fictional) objects?
- What can we say about the essential characteristics of Compositionality and Separability (underlying grammar)?
- Ich fürchte, wir werden Gott nicht los, weil wir noch an die Grammatik glauben. F. Nietzsche; Götzen-Dämmerung (1889).

——— Topics for further research ———

- Are the Freudian cathexis (Besetzung) mechanisms of displacement (Verschiebung) and condensation (Verdichtung), or the Lacanian linguistic / poetic functions of Metaphor (drawing a similarity between two things) and Metonymy (drawing a contiguity) valid examples of composition operators?
- Can we use a literary corpus to build Personality Models? Can we identify more (accurate) traits using semantic information beyond Lexical Analysis?
- ...
- ...

# Is Everything Fictional?

*¿Usted cree que el mundo entero es la metáfora de algo? Neruda abrió la boca... ¿Es una huevada lo que le pregunté, don Pablo? -No, hombre, no- lo que sucede es que me quedé pensando. Mira, Mario. Vamos a hacer un trato. Yo ahora me voy a la cocina, me preparo una omelette de aspirinas para meditar tu pregunta, y mañana te doy mi opinión. ¿En serio?*

- Requires Insightful acknowledgment, not a naïve Boolean answer, concerning the role of metaphor in art and science.
- Naïve Skeptic answer: Everything goes! All is possible!  
Nihilism: No criteria for truth, objectivity, symbol grounding, etc.
- Naïve Realism: Valid knowledge is predetermined, pre-set!  
Conform to “the” status-quo... Empiricism ~ passive learning.
- Cognitive Constructivism: We have great freedom, and also very strong rules, for building true / valid / objective knowledge, for creating art and science in a meaningful way, etc.
- How to engage in this effort? Co-participate in this endeavor?
- A 3-step dance:

# (1) Analysis, Criticism, Deconstruction, Dereification

*Nem pensei mais no redemoinho de vento, nem no dono dele - que se diz - morador dentro, que viaja, o Sujo: o que aceita as más palavras e pensamentos da gente, e que completa tudo em obra; o que a gente pode ver em folha dum espelho preto; o Ocultador. ... Nonada. O diabo não há! É o que eu digo, se for... Existe é homem humano. Travessia.*

João Guimarães Rosa (1951) Grande Sertão, Veredas.



- Jean-François Lyotard: Postmodern condition = collapse of all grand-narratives; Have we gone too far?

## (2) Synthesis, Temporal-Action, Construction, Meaning



*Warum ist Wahrheit fern und weit?  
Birgt sich hinab in tiefste Gründe?  
Niemand versteht zur rechten Zeit!  
Wenn man zur rechten Zeit verstünde,  
So wäre Wahrheit nah und breit,  
Und wäre lieblich und gelinde.*

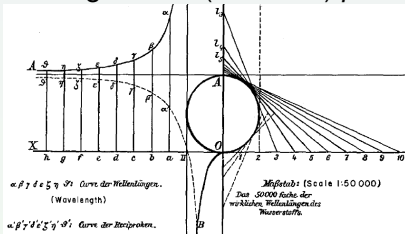
Goethe (1819) West-Östlicher Diwan.

Rosenzweig (1921, 1925): Meaning, truth;  
Sachwort vs. Zeitwort, substantive vs. verb;  
Atemporal objects vs. construction process.



# (3) Evolution, Innovation, Communication, Language

- Two paradigms of evolution in/of life: • Simulated Annealing, ergodic (lonely) path; • Genetic Programming, way of sex, i.e., communication and diffusion of information (repair & innovatn).
- Sex is good! - Holland's schema theorem:  $O(n^3)$  parallelism.
- Communication requires a (shared) Language, for example: Genetic code, DNA, RNA; Human or programming languages.
- Languages must co-evolve with the objects they re-present!
- Art is a source of inspiration and/or innovation, evolution.
- Examples: Language of perspective in art and science:
- Caveat emptor: Transgression (mutation) *per se* is point-less!



# (Bio) Semiotics, (Natural) Forms most Beautiful

- Semiotics (symbols pointing at...) Birds do it, bees do it ...
- Ex: “Hear” the Neotropical Wren’s harmonic duet (musical score), “see” the Tiê Sangue well defined plumage pattern (freedom symbol), “understand” the bees’ dance language.
- Speciation is an evolutionary process in which sharp, stable, separable and composable biological eigen-solutions emerge in the form of musical or visual patterns and languages.
- Semiotics reinforces speciation! (survival/mating selection)
- Language,  $\lambda\omicron\gamma\omicron\varsigma$ , expresses knowledge, but what is that?





# Hierarchical Organization and Modular Structures

Herbert Simon (1996) parable of two watch makers:

Tempus sequential assembly:  $r = 1000$  single elements.

Hora assembly:  $m = 100 + 10 + 1 = 111$  modules of  $r = 10$  parts each, organized in 3 hierarchical levels.

Deterministic environment: One minute to put a part in place.  
Assembly times (minutes). Hora: 1110 ; Tempus: 1000 .

Noise: Interruption/minute with probability  $p = 0.01$ .

Unstable incomplete modules brake down at an interruption.

The expected (random) assembly time of a watch is:

$$\frac{m}{p} \left( \frac{1}{(1-p)^r} - 1 \right) .$$

Assembly (minutes). Hora: 1,173.6 ; Tempus: 2,316,256.5 .

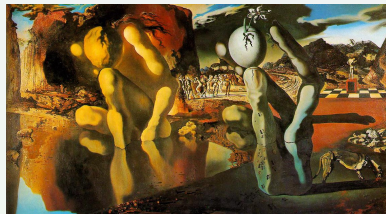
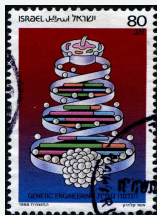
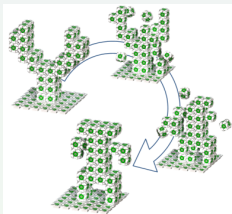
In a noisy world (like ours), complexity - *may* - be very toxic:

Tempus struggles while Hora prospers!

# Logos as Know-How, Software-Power

*Today the “software” comprising the carefully planned interpretive routines, compilers, and other aspects of automative programming are at least as important to the modern electronic calculator as its “hardware” of tubes, transistors, wires, tapes and the like. John W. Tukey (1958) - neologism “software”.*

- Software: Patterns, recipes for (re)assembling, (re)configuring, (re)organizing, components in modular systems.
- (Bio) Semiotics as soft/hard or up/low polarity in structures organized as hierarchical systems, see Rothschild (1962).
- Multi-Strata, Integration  $\Rightarrow$  Self-Awareness, Meta-Cognition...



# Logos as Transcendental Knowledge

*In principio erat Verbum, et Verbum erat apud Deum, et Deus erat Verbum.* Gospel of John, 1:1.

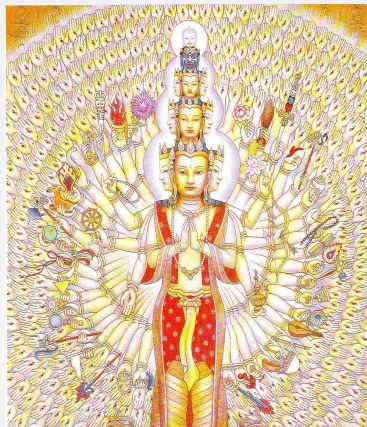


William Blake (1794) *The Ancient of Days*; Paul Manship (1934) *Prometheus*; Georges Colin (1913) *Icarus*.

- After overcoming the dangers of (self) enchantment, can we look up for a transcendent order in the immanent cosmos?
- Will art / science provide a *Clavis Universalis* for meaningful understanding of the world we live in? ...and our actions in it?
- Me voy a meditar la pregunta, y mañana daré mi opinión...

# References / Works of Art

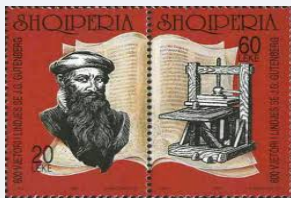
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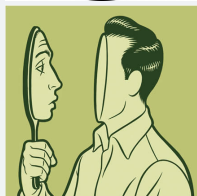
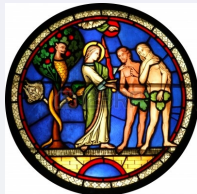
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# FAQ/Thema-1a: Evolution, Genetics, M(n)emetics



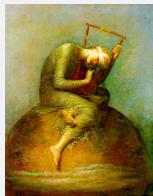
- The Genetic Programming evolution paradigm assumes polar processes of innovation and survival / reproduction selection.
- Evolution is expressed by a dynamic of populations, while
- Genome information is expressed by individual phenotypes.
- Richard Semon (1904): Mneme ( $\mu\nu\eta\mu\eta$ , memory) as a stable memory unit;  $\sim$  Gene ( $\gamma\epsilon\nu\epsilon\alpha$ , generation, offspring).
- Richard Dawkins (1976): Meme ( $\mu\mu\eta\sigma\iota\varsigma$ , to imitate) as a cultural replicating unit: Ideas “live” and prosper (or not) in an evolutionary environment.

# FAQ/Thema-1b: Logos: Il Pagamento del tributo



- *Nada é só bom.* Nelson Rodrigues (1912-1980).
- *Unlike man, animals live without knowing death; An individual enjoys fully the immutability of its gender, being conscious of itself only as an immortal being.* Arthur Schopenhauer (1818).
- *In this world nothing can be said to be certain, except death and taxes.* Benjamin Franklin (1789).

# FAQ/Thema-1c: Hope and Regeneration



- Blind hope - Prometheus' gift to man, after fire (conscience), for overcoming the fear of self-awareness as a mortal being.
- Chinese pictogram for hope = dead (hidden) + king + month (crescent moon); Regeneration in cyclic time.
- Hebrew ThiKVaH: Hope = rope, braid; from KuVaH, stretch, twist, tensely await, endure; Regeneration in linear time (a long rope is made of short individual fibers or threads).
  - *Our death is not an end if we can live on in our children and the younger generation.* Albert Einstein (1926).
  - *L'autore dovrebbe morire dopo aver scritto. Per non disturbare il cammino del testo.* Umberto Eco (1983) *Il Nome della Rosa*.