Metamorphic Thinking in Cartesian Systemic Emergence

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Topics of Interests:

- ❑ Cognitive and computation models
- ❑ Human reasoning mechanisms
- ❑ Modeling brain information processing mechanisms
- ❑ Design of complex recursive problem-solving systems
- ❑ Complex systems design methodologies and techniques
- ❑ Foundations for general systems science
- ❑ Program synthesis of recursive programs from formal specifications in incomplete domains

What are Cartesian Systemic Emergence (CSE) and Metamorphic Thinking (MT)?

CSE – a theory of particular complex systems scientific creation

MT – built-in epistemic self-justification

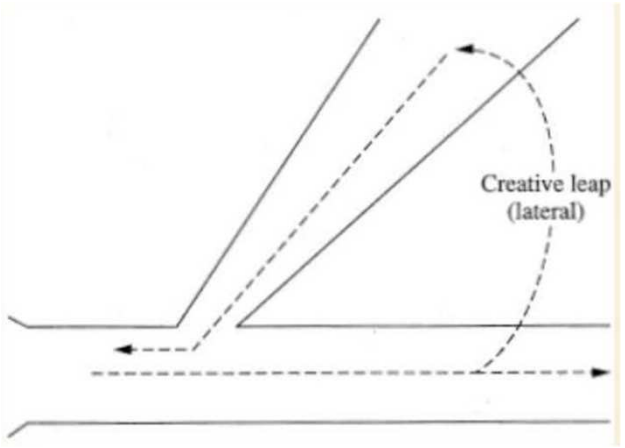
Why a need
for a theory of human scientific creation
and why a need for a (self-)justification?

Related to incompleteness of modern (standard) model of creativity in the context of developing Problem-Solving Systems

Modern model of creativity

an idea must be logical in hindsight, i.e., it must fit in the existing value system

De Bono, Serious Creativity, p. 32



Problem: Does not work for Newtonian and Quantic Physics

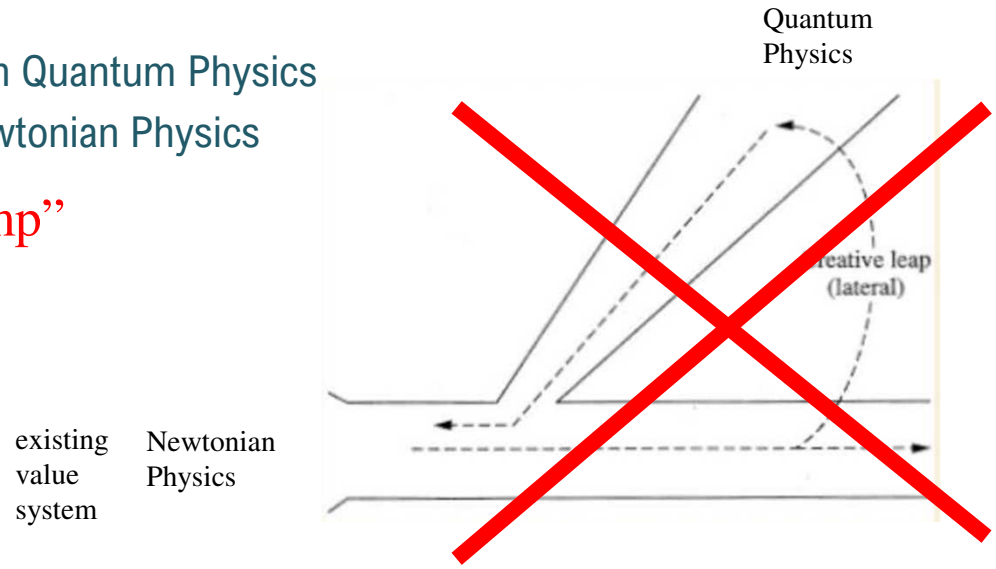
nor for particular problem solving creativity

Modern model of creativity

Problem: Does not work for Newtonian and Quantic Physics
nor for a particular problem-solving creativity

impossible to explain Quantum Physics
in the context of Newtonian Physics

a need for a "jump"



Solution: when relevant, justify the need for "a jump"

Modern model of creativity

Problem: Does not work for Newtonian and Quantic Physics
nor for particular problem solving creativity

Solution: justify the need for “a jump”

If this solution is rejected
=> the linear ‘laterality’-model becomes
an *obstacle* to progress

Suggestion: Accept an agreement
for *on-purpose justifications* of qualitative ‘jumps’

A need for an on-purpose justification: Where?

Economy biased Problem-Solving (PbS) Paradigm

vs.

Progress biased PbS Paradigm

Pb-Solving Paradigms

- **Modular (Economy Biased)**

∀Problem ∃System
solves(System,Problem). **(P1)**

- **Global (Progres Biased)**

∃System ∀Problem
solves(System,Problem). **(P2)**

Economy Biased Modular PbS Paradigm

Paradigm:

$\forall$Problem $\exists$System solves(System,Problem). (P1)

a way of doing:

- Divide & Conquer strategy
- Analysis & Synthesis

$$\text{System} = \bigcup_{i=1}^{FN} \{pb\}_i \subseteq \text{All\_Problems}$$

FN … a finite number corresponding to a finite division of the set All_Problems into distinct classes $\{pb\}_i$

sol_i for $\{pb\}_i$

… obtained by a clever combination/adaptation of already existing tools

… sol_i, sol_j are different from each other and may even be incompatible

Relevance – **modular** systems

Advantages – will be described later

Progress biased PbS Paradigm

Paradigm:

$\exists$System $\forall$Problem solves(System,Problem). (P2)

i.e., all problems are solved in the same way

a way of doing:

… since all problems are solved in the same way,

the System is obtained by a on-purpose 'from-scratch-creation'

Relevance – **symbiotic** global systems

Problem – describe 'from-scratch-creation'

of **symbiotic** global systems

Solution – **Cartesian Systemic Emergence**

The main differences between P1 and P2

- different goals (thus, they are non-competitive)
- different approaches to the development process

  (a modular composition vs. a ‘from-scratch’ symbiotic creation)
- different length of the research processes

  (short term vs. long term)

Cartesian Systemic Emergence (CSE)

What is new ? (in comparison with standard science)

- use of (P2) ∃System ∀Problem solves(System,Problem)
  instead of (P1) ∀Problem ∃System solves(System,Problem)
- handling Ouroboros Property of the system, i.e., S(S) = S
  via Ouroboros process, i.e., $\lim_{n\to\infty} S_{n+1}(S_n) = S$
- conceptual working in the context of non-primitive recursion
- working with informal specifications
  (S_0 … informal specification of S)
- working with underspecified notions and tools
- symbiosis of the system parts
- considered systems: Symbiotic Recursive Pulsative Systems

Cartesian Systemic Emergence

- a different way of doing research because

  different systems are considered
- already seen in ancient times

  (Francis Bacon, René Descartes, Ancient Egypt, …)
- why not understood before?
  - presence of intentionality

    (not considered as an objective feature by modern science)
  - presence and necessity of symbiotic thinking

Cartesian Systemic Emergence – WHY?

- in the nature exist symbiotic systems that have the Ouroboros property

=> necessity to be able to model the creation of Symbiotic Recursive Pulsative Systems in order to develop computer systems able to implement such systems without a loss of emergent properties coherent with the intentionality present in living systems but not in the tools developed by standard creativity

Notions to understand and accept

- informal specification
- symbiosis
- Ouroboros process
- hermeneutic circle

Informal specification

Description of the system in which terms are not yet exactly defined. The exact meaning will depend on constraints, opportunities and ambitions during the construction

Examples:

- "Automate fully the construction of recursive programs via inductive theorem proving."
- "Construct a scientific model of the human brain that solves all the questions and problems related to a *formalization of the brain mental processes*"
- "Knife without a blade, for which the handle is missing."

Absurd? Impossible to obtain?

NOT in a *relevant* context

Symbiosis

By ***symbiosis***, we understand a composition of several parts that is vitally separation-sensitive.

By *vital separation-sensitivity* of a composition, we mean that eliminating one of its parts has three possible consequences. It may be

- a complete destruction or
- a non-recoverable mutilation or
- uselessness of the remaining parts.

Symbiosis of the parts of a system

♦ … a notation for a symbiotic composition

if $S = part_1 \blacklozenge part_2$

then

$Def(part_1) = description\_in\_terms\_of(\ldots, part_2, \ldots)$

$Def(part_2) = description\_in\_terms\_of(\ldots, part_1, \ldots).$

Symbiosis – an easy illustration

young woman ♦ old woman

‘young woman’

‘old woman’

Symbiosis – illustration of systemic symbiosis

ak(x,0) = sf(x)

ak(x,y+1) = ak(x,y) + sf3(x,y)

sf(0) = 1

sf(a1+1) = sf(a1) + sf1(a1)

sf1(0) = 1

sf1(b+1) = sf2(b,sf(b) + sf1(b)).

sf2(0,y) = 1

sf2(a+1,0) = 1 + sf2(a,1)

sf2(a+1,b+1)= sf2(a+1,b) + sf2(a,b+sf2(a+1,b)) – 1

sf3(0,y) = 1

sf3(a+1,y) = sf2(a,ak(a+1,y))

ak is defined in terms of sf3
and
sf3 is defined in terms of ak

Such definitions are
not allowed in standard science

Cartesian Systemic Emergence – an extension of standard science

ak is defined in terms of sf3

and

sf3 is defined in terms of ak

Such definitions are not allowed in standard science

Thus, in order to be able to consider symbiotic systems there is a need to extend standard science

… hence **Cartesian Systemic Emergence**

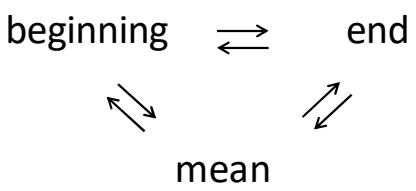
as one of possible extensions

Ouroboros Process

Ouroboros Property of a system:

$$S(S) = S$$

another representation:



Ouroboros process:

$$\lim_{n \to \infty} S_{n+1}(S_n) = S$$

S_0 is informal specification of the system

the most complex step: go from S_0 to S_1

Ouroboros Process – the most complex task

to go from S_0 to S_1 is the most complex task, since this step already must

- anticipate (and thus allow) the whole evolution of Ouroboros Process,
- have a solid and efficient strategy for specifying the primitive notions of S_1 and their symbiosis expressed by the resulting axioms,
- incarnate all methodological fundamentals related to the creation of P2-deductive-like problem-solving systems.

Hermeneutic circle (an extract from Wikipedia)

The **hermeneutic circle** (German: *hermeneutischer Zirkel*) describes the process of understanding a text hermeneutically. It refers to the idea that one's understanding of the text as a whole is established by reference to the individual parts and one's understanding of each individual part by reference to the whole. Neither the whole text nor any individual part can be understood without reference to one another, and hence, it is a circle. However, this circular character of interpretation does not make it impossible to interpret a text; rather, it stresses that the meaning of a text must be found within its cultural, historical, and literary context.

Metamorphic Thinking

it is a justification of CSE that has a form of a hermeneutic circle

> Neither the whole text nor any individual part can be understood without reference to one another. However, this circular character of interpretation does not make it impossible to interpret the description of CSE and MT; rather, it stresses that the meaning of CSE must be found within its technological context.

technological context of CSE (seen previously)

- use of (P2) ∃System ∀Problem solves(System,Problem)
- handling Ouroboros Property of the system and the Ouroboros process of its creation
- conceptual working in the context of non-primitive recursion
- working with informal specifications
- working with underspecified notions and tools
- symbiosis of the system parts
- considered systems: Symbiotic Recursive Pulsative Systems

none of this is present in the standard science

Economy Biased Modular PbS Paradigm

Paradigm:

$\forall$Problem $\exists$System solves(System,Problem). (P1)

Advantages

- became a standard
- allows modular collaborations

Disadvantages:

- unable to deal with symbiotic systems
- unable to deal with informal specifications
- tools missing for handling incompleteness of domains

Progress biased PbS Paradigm

Paradigm:

$\exists$System $\forall$Problem solves(System,Problem). (P2)

Advantages

- able to deal with symbiotic systems
- able to deal with informal specifications
- tools are developed for handling incompleteness of domains

Disadvantages:

- impossibility to be explained in terms of modular standard approach
- long-term research
- 'one-mind' collaborations

Challenge:

- even as a non-competitive extension to standard science it is rejected by the experts of standard science

Conclusion

Cartesian Systemic Emergence brings a progress to modern science at least on three points:

- it justifies P2-creation of Symbiotic Recursive Pulsative Systems,
- it shows that P2-creation requires its own particular kind of presentation, collaboration and evaluation, and
- it shows the inadequate character of the present intellectual property law still unable to protect this atypical kind of long-term research