On an Idea of a (Possibly) Uniform Data Base for Life Sciences from Molecular Biology to Cognitive Psychology

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1 Introduction

Our purpose is to outline an idea of a data base for life sciences (or their methods), from molecular biology to cognitive psychology, where one claims a certain uniformity of data models for the base to provide a common language ground for a discourse and a communication between phenomenal levels: life over (bio)chemistry, cognitive phenomena over life. We do it in Section 2 by sketching a prospect (or a panorama) of the knowledge to be organized in that data base. The prospect contains among others evolutive membrane systems due to Gh. Păun [8] which are expected to be appropriate data models for the base.

The outlined idea of a data base for life sciences has been inspired by the software system RUBATO for data analysis in musical sciences from (auditory) physiology and psychology of perception, counterpoint and harmony theories, to semiotic aspects discussed in musicology and (comparative) theory of performance. The system RUBATO was designed by a group led by mathematician and musicologist G. Mazzola who formulated mathematical foundations of the system in [6].

2 The Prospect

The prospect of the knowledge to be organized into a data base for life sciences is given in Figure 1.

We emphasize in the prospect those known qualitative mathematical models and their theories used in the area of our interest which may serve as data models for the base because of their uniformity providing the mentioned common language ground for a discourse.

Those mathematical models and their theories comprise Gh. Păun's theory of evolving membrane systems [8], still in progress [9], used to describe biochemical processes in cells and then in tissues.

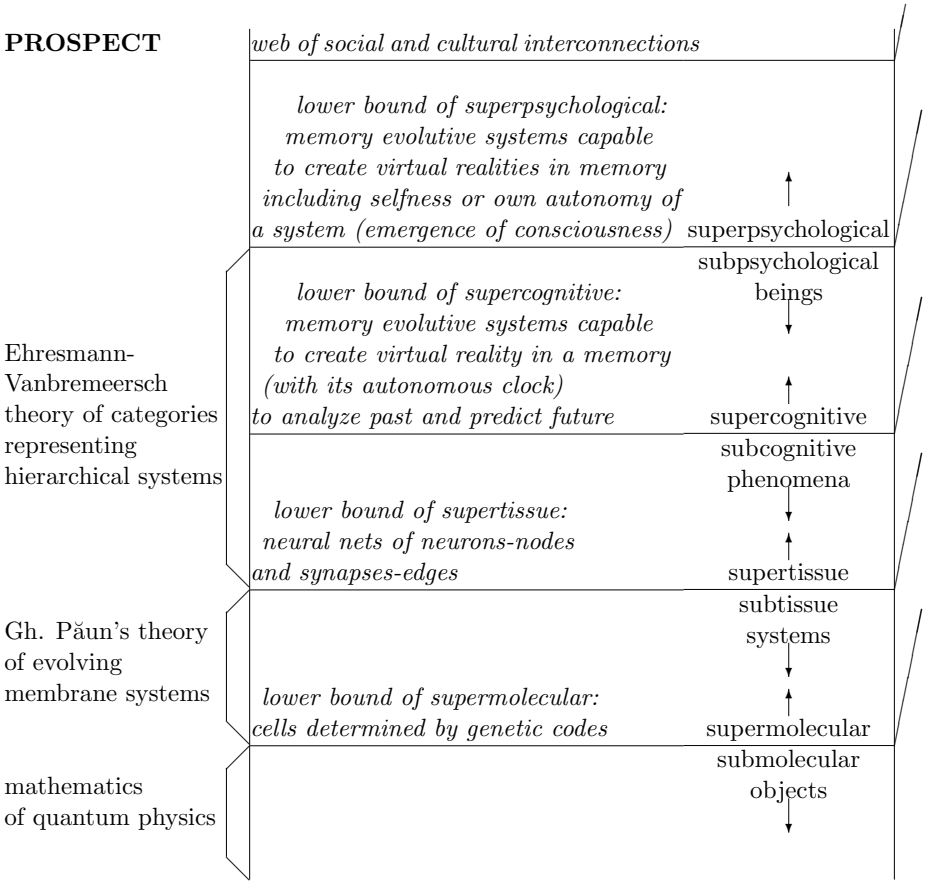
PROSPECT
web of social and cultural interconnections
lower bound of superpsychological:
memory evolutive systems capable
to create virtual realities in memory
including selfness or own autonomy of
a system (emergence of consciousness)
superpsychological
subpsychological
beings
lower bound of supercognitive:
memory evolutive systems capable
to create virtual reality in a memory
(with its autonomous clock)
to analyze past and predict future
supercognitive
subcognitive
phenomena
lower bound of supertissue:
neural nets of neurons-nodes
and synapses-edges
supertissue
subtissue
systems
lower bound of supermolecular:
cells determined by genetic codes
supermolecular
submolecular
objects
Ehresmann-
Vanbremeersch
theory of categories
representing
hierarchical systems
Gh. Păun's theory
of evolving
membrane systems
mathematics
of quantum physics

Fig. 1.

We also include A.C. Ehresmann's and J.-P. Vanbremeersch's theory of hierarchical systems represented by some categories [3], which have been applied to model memory evolutive systems and their evolutive processes of complexification up to emergence of consciousness [4], [5].

The prospect was inspired by [1], where the authors emphasize three general levels: physical, biological, cognitive, and also an internal hierarchical organisation of living entities which is represented in Păun's approach and the Ehresmann-Vanbremeersch theory of hierarchical systems.

We expect that a more uniform treatment of mathematical models discussed in Păun's theory, including (Mem)Brane Calculi, could be provided by a new theory, called *Biological Set Theory*, basing on hereditary finite sets due to J. Barwise [2] and the representation of membrane systems by hereditary finite (multi)sets which was presented in [7].

An extension of Biological Set Theory to capture the approach of Ehresmann-Vanbremeersch is problematic because of Multiplicity Principle [5] which admits multiple internal hierarchical organization of objects (described in terms of colimits of patterns) of categories representing hierarchical systems.

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