Plenary Speech—Pierre Bricage (France)

New Trends on Systems Science and Cybernetics.

Living Systems Structures and Functioning: A Practical CyberSystemic Approach

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ABSTRACT

What is a living system? How to define a living system? Can we get a definition which is independent not only of the dimensional and time scales, but also of the system structure, its level of organization and its degree of evolution? My first paradigm is “the gauge invariance of living systems”: whatever the living system it can be defined by 7 functional capabilities [1]. These properties define what is a level of organization, independently of the system complexity. How do new blueprints of living systems emerge? Every living system can be defined as an endophysiotope (endo: internal, tope: space-time, physio: of functioning) integrated into an ecoexotope of survival(exo: external, tope: space-time, eco: of inhabitation). The ecoexotope is providing a capacity of hosting (or carrying capacity) while, to survive, the endophysiotope needs to express a capacity tobe hosted in adequacy [2].

Living systems are not only embedded and juxtaposed into more complex ones but they a real so embedding previous less complex ones, which are juxtaposed, in an iterated way, a fractalmanner, just like Matryoshka dolls are. My second paradigm is “each jumping step from a previous blueprint to a new one is the merging into an Association for the Reciprocal and Mutual Sharing of Advantages and DisAdvantages”, an ARMSADA [2]. What is an ARMSADA? For more than hundred years, symbiosis has been defined as an association for mutual benefits. That it is not what it is! It is an ARMSADA! Whatever the actors and the interactions into a system -as a Whole-,“there are never advantages without disadvantages“. All that is an advantage for a partner is a disadvantage for another one! If there are some benefits they are only for the Whole. Whatever the kind of structure, type of functioning and level of organization, of both the partners and the Whole, all living systems (bacteria, cells, multi-cell organisms, ecosystems...) are ARMSADAs [3]. Withonly these 2 paradigms we can trace a periodic table of classification of living systems according to their organization levels. These 2 paradigms are falsifiable and fruitful. The ARMSADA paradigm allowed assumptions that has been proved in AIDS and cancer curation research [4]. It could be a key stone principle both for higher education [5], new research trends [6] and ethical governance [7]. Whatever the system complexity [3], it always runs through 2 phases: -a larval phase, which is a growth phase (a phase of persistence and resilience), and “if the self of the system survives long enough to attain a mass threshold”, -an adult phase, which is the reproduction phase, during which “the

system, itself, survives its self“. Indeed the describing parameter is not time: the governing parameter is the mass. Mass growth is determining time duration. If we represent in a log-log plot the relationship between the Volume of the system in its Adult phase VA and its time of generation (e.g. the duration of the growth phase needed to gain the reproductive capacity) tg, we get a line with a 3/2 slope. A power law is thus linking together all the interconnected systems of systems of our Universe as a Whole: VA = C.tg3/2. Indeed, every sub-system we get from the whole Universe system obeys the same power law. And, if we iterate the graph, again with the same kind of log-log plotting, we observe that our Universe is a subsystem of a hyper-universe in which it is embed ded and probably juxtaposed with other Universes. This power law is the fractal law of functioning of all living beings, whatever is their complexity [8]. But what does mean a 3/2 exponent power law?

ABOUT THE SPEAKER

During 8 years at the University of Dakar (Sénégal, Africa), the biological rhythms (experimental study and modelling) of biochemical, ecological, physiological & genetical markers of plant enzymes & pigments were his teaching & research first interests in Biology and Ecology (sustainable management of natural resources and environmental education). During 40 years, he led a career as academic full-time researcher and teacher in biochemistry, enzymology, genetics, microbiology, animal and plant physiology, and systems analysis. As head of the Biology department at the University of Pau, France, he co-founded a regional centre for Agricultural Research. He has taught Systems Theories & Micro-Informatics (Data Bases modelling, programming, simulating) applied to Chemistry, Quality Control, Health and Social Sciences (Societal Engineering and Man's Societal Environmental Responsibility). Since 2000, he is pointing back to Fundamentals in Biology & Systemics Practical Applications with all OnLine “Creative Commons” works. He has been developing new Methods & Key Words in biosystemics (endophysiotope and ecoexotope, “the gauge invariance of life“, phylotagmotaphology), through the new predictive Paradigm of ARMSADA “Associations for the Reciprocal and Mutual Sharing of Advantages and DisAdvantages” with predictive applications in curative vaccines (cancer, AIDS) technology. Now retired, he is Vice-President of the French Association for Systemics and Cybernetics AFSCET, Deputy Secretary General of the European Union for Systemics UES-EUS, Memberof the Directorate of the World Organisation of Systems and Cybernetics WOSC and Secretary General of the International Academy for Systems and Cybernetic Sciences IASCYS.