Contemporary Systems Thinking

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Towards a Post-Bertalanffy Systemics

Springer

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Preface

The title of the sixth national conference of the Italian Systems Society, "Towards a post-Bertalanffy Systemics", aims to underline the need for Systemics and Systems Science to generalize theoretically, interdisciplinarily and trans-disciplinarily using systemic concepts arising from the original or Bertalanffy Systemics, as well as from various disciplines themselves.

The topic of this sixth conference is an evolution of the subjects of previous conferences, namely:

- 2002 Emergence in Complex Cognitive, Social and Biological Systems
- 2004 Systemics of Emergence: Research and Applications
- 2007 Processes of Emergence of Systems and Systemic Properties—Towards a General Theory of Emergence
- 2011 Methods, Models, Simulations and Approaches Towards a General Theory of Change

Consideration was made of the generic first phase of Systemics devoted to overcoming classical mechanistic views, introducing new theoretical approaches studied, for instance, through Automata Theory, Catastrophe Theory, Chaos Theory, Control Theory, Cybernetics, Games Theory, Systems Dynamics, Gestalt, Sociobiology and Theory of Dynamical Systems. This phase can be characterized by the term "General System Theory", introduced by Ludwig von Bertalanffy (1901–1972) to generalize the concept of system by using some key systemic concepts such as interaction, general interdependence, openness and closeness, organization and homeostasis within the general framework of the isomorphism between sciences, searching for the unity of science. This phase continues but, over the past few years, two important cultural and scientific processes are occurring:

- After Systemics used the concept of system and related properties to overcome classical disciplines still tied to principles such as determinism, mechanistic view, summative assumption and linearity, reversibility, single optimum and equilibrium points, the disciplines themselves used in innovative ways the concept of system by introducing theoretical improvements. Examples are given by advances in disciplinary domains such as Theoretical Physics, Biology,

Neuroscience, Experimental Economics and Network Science, the latter being even a possible new version of Systemics itself due to its generality. The concepts and approaches considered by various disciplines using systemic approaches are extremely innovative and beg for their generalization.

- Phenomena are being considered and denoted in different ways, in various disciplines, using different approaches, but all are related to complexity, self-organization and emergence. However, all approaches considered by Systemics have a post-reductionist nature since they are unable to deal, for instance, with coherence and multiple coherences, dynamic structures, multiple models, non-homogeneity, nonequivalences, levels of distinguishability, multiple systems, power laws and scale-free properties.

Whence the original Systemics is suitable for dealing with processes of acquiring and maintaining the same or only a few, fixed systemic properties. Complex open systems, on the contrary, continuously acquire new, multiple, superimposed and often delocalized coherent sequences of properties.

Today it is extremely difficult to find disciplinary areas where the concept of system is not frequently used, albeit within specific contexts.

Indeed today disciplines have become sources, suppliers of new approaches, problems and systemic issues.

The interdisciplinary nature of the original Systemics and its power of generalization were given, overall, by the fact that the problems and solutions of one discipline become problems and solutions for another. Today, the modelling and interpretation of multidisciplinary approaches and representations facilitate this. The context, however, has changed dramatically.

This year's conference was devoted to identifying, discussing and understanding possible interrelationships of theoretical disciplinary improvements recognized as having prospective fundamental roles for a new post-Bertalanffy Systemics able to deal with problems of complexity in a generalized way where interdisciplinarity consists, for instance, in a disciplinary reformulation of problems, as from algebraic to geometrical, from military to political, from biological to chemical, and trans-disciplinarity is related to the study of such reformulations and their properties. Examples of new issues introduced by such theoretical disciplinary improvements and studied within various disciplines include:

Between (the mesoscopic middle way)
Environment
Equivalence
Fractality
Individuality
Induction of properties
Irreversibility
Meta-structural properties
Methods and models to build strategies
Multiple, dynamic coherence
Mutation
Non-prescribability
Non-separability
Ontologies, scenarios and metamodels
Power laws
Pre-properties
Propagation
Quantum theories and concepts
Quasi properties
Quasiness
Symmetry
Structural dynamics

Networks
Non-causality
Nonequivalence
Non-invasiveness
Structural regimes of validity
System propagation
Topological dynamics
Transient

The new interdisciplinarity relates to properties of new representations, as in Network Science when dealing with topology, small worldness, power laws and fitness.

What is our role as a dynamical open network even though officially we are an association?

The challenge is still theoretical generalization and application, even where we have a lot of specificities, but know very little on how to combine them.

It is not simply replacing the old with the new, but to develop strategies to recognize, represent, model and act on new levels and combine, by considering, for example, multiple representations, functions and emergence.

In various disciplines this is already done, and inevitably well, since targets and projects are well specified and oriented.

The challenge is to do it for Systemics, with the vocations of cultural and theoretical generalization. The subject matter was explored through five sessions:

1. Studies of Emergence, Models and Simulations
2. The Contribution of Physics to a New General Theory of Systems
3. New Systemic Contents of Disciplinary Approaches and Problems
4. New Forms of Inter- and Trans-disciplinarity
5. Outlines of a New General Theory of Systems

The conference was opened with the plenary lecture by Emeritus Professor Fortunato Tito Arecchi, entitled "Quantum Effects in Linguistic Endeavors".

We conclude by mentioning that the Italian Systems Society does not want to perpetuate a role but, rather, contribute to the context-sensitive emergence of new, eventually collective, roles in an age where disciplines have a very high theoretical and applicative specialized systemic content and high interdisciplinarity but still require theoretical generalizations and suitable generalized approaches such as those studied by Network and Quantum Science as listed above. Systemics should also consider suitable cultural versions of such issues.

Milano, Italy
Milano, Italy
Pavia, Italy
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Gianfranco Minati
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We have been honoured by the presence of Professor Fortunato Tito Arecchi who delivered the opening plenary lecture.

We thank ARTEMIS NEUROSCIENCES, Rome, who sponsored the conference.

We thank the PONTIFICAL ATHENEUM S. ANSELMO for hosting the conference.

Thanks are also due to all the authors who submitted papers for this conference and in particular the members of the programme committee as well as the referees who have guaranteed the quality of the event.

We thank explicitly all the people who have contributed during the conference, bringing ideas and stimuli to this new phase of the scientific and cultural project of Systemics.

Editor Biography

Gianfranco Minati, Mathematician, Founder and president of the Italian Systems Society (AIRS); Doctoral lecturer at the Polytechnic of Milan; Member of the scientific committee of Conferences and Systems Societies. He is author of 32 chapters in books; editor of 7 books and journals; author or co-author of 15 books; author of 30 articles and of academic publications. His current research interest focuses on 1) Modelling processes of emergence by using Meta-Structures; 2) the emerging of a post-Bertalanffy Systemics; 3) the Dynamic Usage of Models (DYSAM), Logical Openness; 4) Architecture and Design as the design of social meta-structures to influence processes of emergence in social systems.

Mario R. Abram, Physicist, is an active member of the Italian Systems Society (AIRS). He worked mainly in ENEL (Italian Power Agency), at Research Department (Automatica Research Center), then in Cesi S.p.A. and Cesi Ricerca S.p.A. He experienced hybrid and digital simulation systems, working on models of power systems, thermoelectric and nuclear power plants and processes control. He participated in the building of real-time simulators for thermoelectric power plants and their application to control systems testing and tuning, in the development of supervision and control systems for power testing facilities and distribution networks. Also he worked on the application of neural networks to power systems supervision and investigated safety conditions in interactions between infrastructures. He authored several publications in systems science. His research interests include: dynamical systems, modelling and simulation of processes and interactions between infrastructural networks.

Eliano Pessa, Theoretical Physicist, is actually Full Professor of General Psychology and Cognitive Modeling at the University of Pavia, Italy. He has already been Dean of the Department of Psychology and of the Inter-departmental Research Center on Cognitive Science in the same university. In the past he has been Associate Professor of Artificial Intelligence at the University of Rome "La Sapienza", Faculty of Psychology. He is author or co-author of 10 books and of a large number of papers on scientific journals, books, proceedings of international conferences. His scientific

research interests include: quantum theories of brain operation, computational neuroscience, artificial neural networks, models of emergence processes, quantum field theory, models of phase transitions in condensed matter, models of human memory and visual perception, models of decision making, models of statistical reasoning.

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