Università Cattolica del Sacro Cuore (UCSC)
Associazione Italiana per la Ricerca sui Sistemi (AIRS)

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Settimo Congresso Nazionale di Sistemica

Seventh National Conference on Systems Science

Sistemica dell'Incompletezza e Quasi-Sistemi

Systemics of Incompleteness and Quasi-Systems

RIASSUNTI

ABSTRACTS

Lezione introduttiva di / Opening Lecture by
Giuseppe Longo, École Normale Supérieure, Paris

Importance of Negative Results in Science. The Role of Past Histories and Rare Events in Systems of Life

Sede del Convegno: Università Cattolica del Sacro Cuore
Largo Gemelli, 1 – 20123 Milano, Italy

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Thursday 16 th - Friday 17th November, 2017

In memoria del / In memory of Professor George J. Klir

DEDICATION

Questo Congresso è dedicato alla memoria del Prof. George J. Klir, uno dei più grandi scienziati che la Sistemica possa vantare. Klir era nato a Praga il 22 Aprile del 1932 ed è morto a Binghamton, nello stato di New York, il 27 Maggio 2016. L'elenco dei suoi contributi alla Sistemica, degli incarichi da lui ricoperti e dei riconoscimenti accademici da lui ricevuti è talmente lungo che sarebbe impossibile condensarlo nelle poche parole di questa dedica. Alcuni nomi dei domini in cui Klir aveva lavorato, più che come contributore come un vero e proprio creatore, bastano da soli a dar conto della dimensione dei suoi interessi e della sua vulcanica attività: modellizzazione e simulazione dei sistemi, progettazione logica dei sistemi, architettura dei computer, matematica discreta, sistemi intelligenti, teoria dei fuzzy sets, logica fuzzy, teoria delle misure generalizzate, soft computing. La sua attività accademica è stata anch'essa assai intensa: moltissimi studenti e studiosi hanno imparato la Sistemica sui 17 libri da lui scritti e, diventato direttore del Department of Systems Science nella sede di Binghamton della New York State University, ha seguito come tutor ben 30 dottorandi. È stato anche fondatore e direttore dell'*International Journal of General Systems*. In breve, George Klir è da annoverare tra i "creatori" della Sistemica attuale.

Tuttavia la cosa forse più importante da ricordare è che George è stato anche una persona straordinaria, dotata di qualità umane eccezionali. Chi ha condiviso con lui alcuni momenti della propria vita lo ricorda come uomo gentile e nello stesso tempo aperto verso tutti gli aspetti della vita e del mondo, capace di discutere di un teorema matematico e nello stesso tempo di interessarsi attivamente di pittura, grande conoscitore della vita e ricco di straordinaria esperienza umana. Ben lontano dall'immagine tradizionale dello scienziato, era capace di impegnarsi in vere e proprie avventure, come la traversata a nuoto del lago Oneida, la discesa del fiume Colorado lungo il Grand Canyon, la visita della base Antartica non lontano dal Polo Sud, il percorso a piedi in Nepal fino al campo base dell'Everest (raggiungendo i 5437 m del Kala Pattar). In sintesi, Klir è stato un "grande maestro" di scienza e di vita, una figura cui ben possono ispirarsi gli attuali cultori della Sistemica, ben rappresentati in questo Congresso.

Eliano Pessa

INDICE / INDEX

CHI SIAMO / ABOUT US

L'Associazione Italiana per la Ricerca sui Sistemi (AIRS) (http://www.airs.it) è stata fondata nel 1996. L'AIRS è una rete di accademici, scienziati, ricercatori e professionisti operanti nel campo della Sistemica. Una lista parziale delle discipline rappresentate è:

- Architettura	- Educazione	- Ingegneria	- Musica
- Biologia	- Filosofia	- Matematica	- Neuroscienze
- Economia	- Fisica	- Medicina	- Psicologia

The Italian Systems Society (AIRS) (http://www.airs.it) was founded in 1996. AIRS is a network of academics, scientists, researchers and professionals involved with Systemics. The list of disciplines represented includes:

- Architecture	- Education	- Medicine	- Philosophy
- Biology	- Engineering	- Music	- Physics
- Economics	- Mathematics	- Neuroscience	- Psychology

I congressi hanno avuto come relatori invitati i Professori Arecchi, Haken, Klir e Kauffman.
Previous AIRS conferences have had distinguished plenary lecturers including Professors Arecchi, Haken, Klir and Kauffman.

Gli atti dei congressi sono stati pubblicati come:
The list of published proceedings includes:

1. Minati, G., Abram, M. and Pessa, E., (Eds.), (2016), *Towards a Post-Bertalanffy Systemics*. Springer, New York.
2. Minati, G., Abram, M. and Pessa, E., (Eds.), (2012), *Methods, Models, Simulations and Approaches. Towards a General Theory of Change*. World Scientific, Singapore.
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TEMATICA DEL CONGRESSO

L'incompletezza è la libertà del divenire

I modelli classici della Sistemica hanno la finalità di rappresentare completamente aspetti di fenomeni e processi, come il moto di un pendolo oppure il funzionamento di un amplificatore. Riguardano cioè i fenomeni nella loro completezza temporale e spaziale.

L'eventuale incompletezza della modellizzazione può avere natura provvisoria o pratica in quanto ancora in fase di studio e perché vi sono ragioni teoriche per cui la modellizzazione non possa essere completa. In linea di principio ciò riguarda fenomeni non complessi, affrontabili con i concetti della prima Sistemica, [1,2,3,4].

Sono stati già introdotti in letteratura concetti ed approcci riguardanti contesti e processi per i quali la modellizzazione di sistemi possa non essere concettualmente esaustiva [5]. Ricordiamo innanzi tutto i fuzzy sets e la fuzzy logic [6,7] per i quali tuttavia l'incompletezza è solo di natura probabilistica. Si ha a che fare con una probabilità classica, calcolabile.

La probabilità certa è intesa qui come caratterizzata da possibili, significativi valori estremi, ad esempio minimo o massimo, del divenire fenomenologico di ogni processo, ed è calcolabile, ad esempio, tramite il teorema di Bayes. Per probabilità incerta si intendeuna probabilità non computabile riferendosi alla non prevedibilità dei processi, per esempio, di emergenza che non possono essere completamente modellati in modo esplicito e univoco.

Alcuni fenomeni, poi, sono da modellizzare prendendo in considerazione eventualmente sistemi aventi modelli molteplici che dipendono degli aspetti considerati, come elettrici e meccanici, economici e sociologici, biologici e psicologici, essendo la loro coerenza un tema sistemico di fondo [8], che inoltre riguarda la loro completezza o esaustività, come considerato dal Dynamic Usage of Models (DYSAM) [9, pp. 64–75] e dalla logical openness [10,11].

Altro invece è il caso occorrente quando l'incompletezza è intrinseca, teorica [12] e riguarda la non modellizzabilità intrinseca perché l'incompletezza è una caratteristica stessa del processo in studio. Consideriamo qui contesti e processi per i quali la modellizzazione tramite sistemi è incompleta, dato che interessa solo alcune proprietà, e quelli per cui è teoricamente incompleta, come nel caso dei processi di emergenza e degli approcci della Seconda Sistemica [1]. Un esempio di tale incompletezza riguarda sistemi multipli, sovrapposti e variabili nel tempo, come nel caso dei comportamenti collettivi, che mantengono coerenza a fronte di una dinamica strutturale continua, caratterizzata da correlazioni e invarianza di scala [13].

Al riguardo si utilizza il concetto generico di *quasi* esplicitante tale incompletezza. Il concetto di quasi è usato in vari ambiti disciplinari come i quasi-cristalli, le quasi-particelle, i quasi-electric fields, e la quasi-periodicità. Possiamo inoltre prendere in considerazione il concetto di quasi-sistemi [14]. In

generale il concetto di quasità per i sistemi riguarda il loro continuo cambiamento strutturale, sempre meta-stabile, in attesa di eventi per collassare su altre configurazioni e stabilità possibili, la cui equivalenza o meno è legata al tipo di fenomeno in studio. Il concetto di quasità non interessa per il suo significato di approssimatività, ma perché indicante una incompletezza strutturalmente sufficiente per ospitare processi di emergenza e mantenere coerenza o generarne livelli nuovi, equivalenti o meno. La quasità riguarda anche approcci come quelli dei modelli a rete, in questo caso quasi-reti. Un concetto correlato è quello di sloppiness teorica nei modelli in fisica, biologia e altro [15].

L'attenzione è sul transiente, sulla molteplicità e sulla coerenza che garantiscono consistenza. Inoltre si vuole sottolineare come l'incompletezza teorica, la non-modellizzabilità completa, cioè non esaurita da singoli modelli, di processi e fenomeni vada esplorata come convivenza concettuale di approcci diversi, non tanto con lo scopo di esaurire ma di rappresentare concettualmente la dinamica strutturale del divenire, già presente alla base, per esempio, dei principi di indeterminazione e di complementarietà in fisica, pur senza far riferimento qui alla fisica quantistica. Esempi di questa dinamica caratterizzano gli ecosistemi, i comportamenti collettivi, i sistemi sociali e le polipatologie.

La disponibilità di approcci teorici efficaci è cruciale per l'economia della società corrente [16] dove si tratta di operare in contesti che devono la loro complessità, ad esempio, ad alta virtualità, cambiamenti molto rapidi e ad alta decentralizzazione, di natura reticolare. Un esempio di tematiche è dato dalle problematiche di rating, ovvero di valutazione e di utilizzo di sistemi di dati economici disomogenei in base a cui decidere riguardanti imprese, progetti, e l'attività bancaria. Si tratta di sviluppare conoscenza per l'attuale società della conoscenza (o dell'informazione che dir si voglia) o post-industriale. Molti approcci oggi usati sono ancora quelli della società industriale dove era possibile parlare, ad esempio, di pianificazione, previsione e regolazione.

Il congresso ha la finalità di esplorare casi e presentare approcci in questo contesto concettuale. Concludiamo osservando come questa impostazione sia omogenea e specificante degli approcci della Sistemica post-Bertalanffy considerati nel congresso precedente [1].

CONFERENCE THEME

Incompleteness as the freedom of becoming

Classical models of Systemics are intended to completely represent aspects of phenomena and processes, such as the motion of a pendulum or the operation of an amplifier. They concern the phenomena in their temporal and spatial completeness. The possible incompleteness in the modelling is assumed as having a provisional or practical nature as being still under study and because there is no theoretical reason why the modelling can not be complete. In principle, this is a matter of non-complex phenomena, to be considered using the concepts of the First Systemics [1,2,3,4]. Concepts and approaches regarding contexts and processes for which systems modelling can not be conceptually exhaustive have already been introduced in the literature [5]. We recall, first of all, fuzzy sets and fuzzy logic[6,7] for which, however, completeness has merely a probabilistic nature. It is a matter of classical, computable probability.

Probability is understood here as being certain when computable and characterized by possible, significant extremes, such as minima or maxima, of the phenomenological becoming of any process, which is free to occur within such extremes as, for example, when computed using Bayes' theorem. For uncertain probability we intend here a non-computable probability, for instance, the non-predictability of processes of emergence which can not be fully modelled in an explicit and unambiguous way.

There are phenomena, then, which must be modelled by resorting to systems using multiple models according to the characteristics considered, such as their electrical or mechanical, economic or sociological, biological or psychological aspects, their coherence being a crucial systemic theme [8] also with regard to their completeness or comprehensiveness as considered by the Dynamic Usage of Models (DYSAM)[9, pp. 64-75] and Logical Openness[10,11].

It is another case when the incompleteness is intrinsic, theoretical [12] and regards the intrinsic impossibility of modelling because the incompleteness itself is a characteristic of the process under study. We consider here contexts and processes for which modelling through the use of systems is incomplete since related to only some properties, as well as those for which such modelling is theoretically incomplete as in the case of processes of emergence and for approaches considered by the Second Systemics [1].

An example of such incompleteness regards multiple systems, overlapping and variable over time, such as the case of collective behaviours which maintain coherence despite the continuous nature of their structural dynamics, possessing both correlations and scale invariance [13].

In this regard, we consider here the generic concept of *quasi* explicating such incompleteness. The concept of quasi is used in diverse disciplines as for quasi-crystals, quasi-particles, quasi-electric fields, and quasi-periodicity.

Thus one may consider the concept of quasi-systems[14]. In general, the concept of quasiness for systems concerns their continuous structural changes

which are always meta-stable, waiting for events which lead to their collapse over other configurations and possible forms of stability, whose equivalence depends on the type of phenomenon under study. The interest in the concept of quasiness is not related to its meaning of rough approximation, but because it indicates an incompleteness which is structurally sufficient to accommodate processes of emergence and sustain coherence or generate new, equivalent or non-equivalent, levels.

Quasiness also concerns modelling approaches such as network models, in this case called quasi-networks. A related concept is that of theoretical sloppiness referring to models in physics, biology and other disciplines [15].

The focus is on the transient, on multiplicity and coherence which guarantee consistency. Furthermore, we consider how theoretical incompleteness, incomplete modelling, i.e., not exhausted by using individual models, of processes and phenomena should be explored as a conceptual coexistence of different approaches not so much with the purpose of exhausting but to conceptually represent the structural dynamics of becoming, already considered, for instance, through the use of uncertainty and complementarity principles in physics, without referring here to quantum physics.

Examples include ecosystems, collective behaviours, social systems, and poly-pathologies. The availability of modern, effective theoretical approaches is crucial for the economy of today's society [16] in order to deal with contexts which owe their complexity, for example, to high virtuality, very fast changes and high levels of decentralization, having a distributed, reticular nature. One example of the themes considered here is that of rating issues, that is of evaluation and use of inhomogeneous economic data, according to which one can make decisions, concerning companies, projects, and banking. It is a matter of developing knowledge for the current knowledge, information or post-industrial society.

This conference aims to explore cases and present conceptual approaches within the novel context described above.

We conclude by observing how this setting is conducive to the use of post-Bertalanffy Systemics as considered in the previous Conference [1].

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I TEMI

Anche per questa edizione il congresso vuole costituirsi come un laboratorio virtuale in cui le tematiche come quelle sopra delineate e i temi sotto indicati siano trattabili e declinabili trasversalmente e tuttavia presentati in ambiti disciplinari di origine, maggiormente frequentati per qualsiasi motivo. Si invita a presentare casi non solo leggibili secondo approcci del tipo delineato sopra ma ancora mancanti di soddisfacenti sistemazioni teoriche. La strutturazione sotto proposta è quindi indicativa e da popolare di contributi che trovano affinità che gli autori dovranno comunque indicare esplicitamente. I contributi potranno essere di varia natura come applicativi, teorici, riguardanti modelli, simulazioni, sperimentali e filosofici.

- Il concetto di incompletezza e quasità nella scienza e in filosofia.
- Modelli di incompletezza e di quasità.
- Incompletezza e quasità nella Sistemica della complessità post-Bertalanffy.
- Emergenza, quasità e incompletezza. Mantenimento, crisi e degenerazione in fenomeni di emergenza.
- Incompletezza e quasità nei sistemi sociali.

TOPICS

This edition of the Conference also wishes to establish itself as a virtual laboratory where issues such as those outlined above, and the topics listed below, can be transversely treated and declined, however they be considered within the disciplinary areas of their origin. We invite all participants to present cases regarding not only approaches of the type outlined above, but also examples for which no satisfactory theoretical frameworks are yet available. The structure of the themes proposed below is therefore indicative, and to be populated with contributions having whatever affinities the authors wish to make explicit. Contributions may be of different kinds, including applications, theoretical approaches, or regarding models, simulations, experimental or philosophical aspects.

- The concept of incompleteness and quasiness in science and philosophy.
- Models of incompleteness and quasiness.
- Incompleteness and quasiness in post-Bertalanffy Systemics complexity.
- Emergence, quasiness and incompleteness. Maintaining, crises and degeneration in emergence phenomena.
- Incompleteness and quasiness in social systems.

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ATTI / PROCEEDINGS

Gli atti saranno pubblicati da Springer.
Proceedings will be published by Springer.

LAVORI / PAPERS

Opening Lecture	Giuseppe Longo	Importance of Negative Results in Science. The Role of Past Histories and Rare Events in Systems of Life

Opening Lecture	Lucia Urbani Ulivi	Has Systemic Thinking an Ontological Commitment?

1.	Mario R. Abram	Decomposition Breaking
2.	Mario R. Abram, Eliano Pessa	Information Technologies and Regulations
3.	Salvatore R. Arpaia, Gianluca Bocchi	Beyond the limits of computation: researching for meta-computational approaches in modelling biological and human systems
4.	Salvatore R. Arpaia, Roberta Di Pasquale	Incompleteness and construction of meaning in psychotherapy: steps to the definition of meta-computational approaches in psychology
5.	Pier L. Bandinelli, Alvaro Busetti	The management complexity of a hospital psychiatric ward: a "small world" approach
6.	Elena Bartolini	Systemic ontology and Heidegger's ontology: a discussion on systems and $\lambda\acute{o}\gamma o\varsigma$
7.	Leonardo Bich	The problem of functional boundaries in prebiotic and inter-biological systems
8.	Lucio Biggiero	A note on basic aspects of economic organizations and social systems
9.	Natale S. Bonfiglio, Roberta Renati, Eliano Pessa	The use of Brain Computer Interfaces (BCI) combined with serious games for pathological dependence treatment
10.	Giordano Bruno	Need for a "Systetics"
11.	Umberto Di Caprio, Mario R. Abram	An Example of Quasi-System in the Generation and Transmission of Electrical Power
12.	Francesco Dossi	Theatrical organicism: thoughts on drama and system theory
13.	Rodolfo Fiorini	Embracing the unknown in post-Bertalanffy systemics complexity modeling
14.	Carlotta Fontana	Architecture and systemics – performance revisited

15.	Aldo Frigerio	Sentences as systems. The principle of compositionality and its limits
16.	Alessandro Giuliani	All the shades of incompleteness: the singular case of structure/function relations in biochemistry
17.	Marco Giunti	Are dynamically undecidable systems ubiquitous?
18.	Carlos Guerra Nieto	Dynamic systems and relationship with movement, training and pain
19.	Ignazio Licata	The quantum quasiness from Bohr to the Bell loophole tests
20.	Antonio Lizzadri	The idea of incompleteness in the internal realism of Hilary Putnam
21.	Pier Luigi Marconi, Maria P. Penna, Eliano Pessa	The psychopathological process as a system of dysfunction and systemic compensation with top-down modulation
22.	Irune Medina	A Systemic Approach to Political and Religious Communication: two case studies
23.	Gianfranco Minati	Does Systemics still need theories?
24.	Gianfranco Minati	On some current systemic open issues
25.	Eraldo F. Nicotra, Andrea Spoto	Connections and dissimilarities among Formal Concept Analysis, Knowledge Space Theory and Cognitive Diagnostic Models in a systemic perspective
26.	Roberto Peroncini, Rita Pizzi	Values for Some. How Does Criminal Network Undermine the Political System? A Data Mining perspective
27.	Emanuela Pietrocini, Maurizio Lopa	Music: creativity and new technologies. A systemic approach towards multimedia project and sound design
28.	Andrea Roli	On the complexity of baroque music and implications on robotics and creativity
29.	Andrea Roli, Marco Villani, Roberto Serra	A view of criticality in the Ising model through the Relevance Index
30.	Francesco Sulla, Usebia Armenia, Dolores Rollo	Natural Rates of Teachers' Approval and Disapproval in Italian Primary and Secondary Schools Classroom
31.	Guido Tascini	AI-Chatbot Using Deep Learning to Assist the Elderly
32.	Martino Tosi	Temporal ambiguity: music between coherence and incompleteness
33.	Francesco Zanotti	Economy and quantum thinking

OPENING LECTURE

IMPORTANCE OF NEGATIVE RESULTS IN SCIENCE. THE ROLE OF PAST HISTORIES AND RARE EVENTS IN SYSTEMS OF LIFE

Giuseppe Longo

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Science constructs tools for knowledge and, occasionally, this bold enterprise may let a few believe in the "completeness" of a given theoretical frames. Yet, negative results, often based on the very tools proposed by the scientific approaches, set the limits to knowledge construction and opened the way to new science. Scientism instead assume to increasingly and completely occupy reality by already given tools. Biology has been dramatically affected by the myth of completeness of molecular descriptions, both in ontogenesis and phylogenesis. The richness of organismal individuation and the intrinsic unpredictability of phylogenetic dynamics is then lost as well as the open ended changes of the pertinent phase space of biological evolution. Jointly to an appreciation of the role of rare events in evolution, some understanding of the limits of knowledge set the grounds for new approaches and may help to focus on more suitable a priori for the science of life.

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OPENING LECTURE

HAS SYSTEMIC THINKING AN ONTOLOGICAL COMMITMENT?

Lucia Urbani Ulivi

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Since its first steps in ancient Greece, philosophy has posed the ontological question: what should be recognized as real, and why? The question received different and heterogeneous answers in the course of history of philosophy, and my aim is to discuss whether it is possible to derive a coherent ontological proposal from the premises of systemic thinking.

I will claim that systemic thinking is committed to pluralism both in epistemology and in ontology, because pluralism is a natural consequence of the systemic distinction of objects in different and irreducible levels of observation.

If we recognize that we must adopt different levels of observation to describe different systemic levels (the well-known sub-systems, systems, systems of systems), we imply that we accept different epistemologies, each having its own criteria and validation methods suitable for each level, and that there are irreducible ontological differences among entities. We are thus committed to ontological and epistemological pluralism.

An interesting moral and social consequence of pluralism is a tolerant attitude towards different perspectives and cultures, that can easily be transformed into a general "charity principle" inspiring the regulation of multicultural societies.

1

DECOMPOSITION BREAKING

Mario R. Abram

Decomposition methodology is used to characterize a system by means of the specification of relations between the defining properties. The appearing of errors during the application of the methodology changes the characterization of the system and in some cases breaks the decomposition process. A single error can shadow the structure of the system and lead to the separation of the system into two or more subsystems. With the help of a simulation example it is possible to show the application of decomposition methodology with and without errors. Different definitions of systems come out and, in some cases, the decomposition breaking leads to particular configurations that can help to individuate quasi systems.

2

INFORMATION TECHNOLOGIES AND REGULATIONS

Mario R. Abram, Eliano Pessa

Regulations constitute the "corpus" of rules defining the protocols rising from the interactions between people, organizations, environment in all their aspects and implications. Information technologies are modifying these rules and call for the improvement and the update of interaction codes in order to manage and organizing the emergence of a new reality unknown until now. There will be always a delay between the manifestation of a new interaction, encouraged and powered by communication and information technology, and the setting of an appropriate regulation. As a consequence, a situation of constant mismatching between "living technology" and regulations development seems a problem of difficult solution.

3

BEYOND THE LIMITS OF COMPUTATION: RESEARCHING FOR META-COMPUTATIONAL APPROACHES IN MODELLING BIOLOGICAL AND HUMAN SYSTEMS

Salvatore R. Arpaia, Gianluca Bocchi

Stuart Kaufmann's entire work is devoted to understand how and why biological and human systems wholly escape deterministic frameworks herited by Newtonian science, researching consequently new models and approaches more useful to understand the many peculiarities of this kind of systems. In Kaufmann's argument an important step is taken when he shows how all the relevant processes in molecular biology do entail a phase space, resulting from all the possible combinations of basic elements (e.g. aminoacids in a proteinic chain), that is literally transcomputational, implying numbers that cannot be computed even by a very powerful and huge computer operating since the beginning to the very end of our universe. Precisely, biological and a fortiori human systems are the field that instatiates the mathematical idea of Bremermann's limit, aiming at a formalization of a threshold beyond which it should be impossible to compute numbers through any kind of human and artificial means.

Furthermore, there's an even stronger limit to computation in Kauffman's view. He considers impossible to define and a fortiori to compute the very number of entities intervening in natural and human history and even more the number of their relationships, since new relationships take place in every moment, and a good deal of these relationships are instrumental to create new entities.

Stuart Kaufmann's vision does indeed converge with other relevant arguments concerning the computational limits in modelling of complex systems, such as Borel's and von Bertalanffy's views and the mathematical proposals that are regrouped under the labels of ultrafinitism (Nelson) and strict finitism (Fang Ye). But the attitude to be taken with these arguments in mind is not to eliminate any role for formalization, but rather to define precise roles for precise kind of formalization and to generate a complementarity relationship to non formal (e.g. narrative) approaches. One of the most promising strategies amounts to move from a modeling of a single complex system, that would have to face with the difficult problems of a very huge number of parts of the system itself and their past, present, future relationships, to a modeling aiming at studying the successive phases in the evolution of such a system, generating a meta-context in which the system becomes a non-analyzable entity: rather, the focus concerns the relationships between the different states of the system.

Gregory Chaitin's perspective, based on the ideas and formal tools created by

Gödel and Turing for the proofs of incompleteness and undecidability theorems, is a relevant contribution in this direction, where a metabiology is proposed with an organism as a program and its evolutionary path as an algorithm transforming the program into a more efficient one. But this kind of approach may be very useful in social and psychological sciences, particulary in psychotherapy where it's often necessary to study the phase transitions of the whole system without scattering the approach in following the transformation of the multiple parts composing the system, that are generally very difficult to be identified and determined.

4

INCOMPLETENESS AND CONSTRUCTION OF MEANING IN PSYCHOTHERAPY: STEPS TO THE DEFINITION OF META-COMPUTATIONAL APPROACHES IN PSYCHOLOGY

Salvatore R. Arpaia, Roberta Di Pasquale

In systemic psychology a therapeutic change process for a cognitive system is interpreted as a process of creation of a meta-context by which the system could solve an undecidable situation. Examples of this approach can be found in Bateson relational psychology, and in the following studies by Selvini Palazzoli and the Milan school. Moreover, recent developments in narrative psychology suggest that this change process could be studied as the construction of networks of meanings by which the system modifies some of his behavourial rules. Although this kind of approach to psychotherapeutic practice is a very promising one, the limit of this approach consists in the lack of classical predictive models, since the phase transitions of the cognitive systems implies a non-computable number of elements to be considered.

On the other hand, in XX century epistemology the notion of undecidability is deeply connected with the notion of incompleteness: following Gödel's theorems, every formal system (i.e. a formal language on which it has been defined a notion of formal provability) including arithmetic is incomplete in the precise sense that there exist propositions of the formal language that are undecidable within the formal systems.

Following Chaitin's meta-biology, in which an organism is seen as a non-decomposable entity (a program) and its evolutionary path as an algorithm transforming the initial program in a more efficient one, we consider a cognitive system facing a psychopathology as a formal system (a program) facing one undecidable proposition, and a therapeutic process as an algorithm transforming the formal system in a new system for which the proposition are make decidable (new meanings' networks are created). The focus is now in the phase transition

of the system, seen as a simple unity, and the therapeutic process is analyzed as a process by which a metacontext aimed to the construction of new meanings and rules is created.

In the definition of predictive models, we can thus switch from the analys of continuous processes based on classical differential calculus, to the analys of discrete processes (involving a very low number of elements) using discrete algebraical tools.

This meta-computational approach, that lies within the conceptual framework of second-order cybernetic, throws a new light on the relations between narrative and formal approaches in psychotherapy. We will show examples of this method taken from the analysis of a clinical case.

5

THE MANAGEMENT COMPLEXITY OF A HOSPITAL PSYCHIATRIC WARD: A "SMALL WORLD" APPROACH

Pier Luca Bandinelli, Alvaro Busetti

Unlike other hospital departments whose internal processes can be considered either a linear or "waterfall" system, the psychiatric one should be considered a highly complex nonlinear system, since each patient must be managed across many different dimensions on top of the clinical one, to manage which different organizational / procedural problems have to be considered which are hardly manageable in a synchronized and cohordinated way. Moreover, the turnover of most of the personnel frequently disrupts even the continuity of the single process. Therefore, the complexity and the variability both of the system and the interactions between people involved with different roles on the different aspects of the management of the same patient defines the psychiatric department as an intrinsically complex (as opposed to complicated) system hard to linearize and to manage following a traditional, i.e. mechanistic, approach. It is therefore proposed to analyze the operations of the department as a closed social network of the "small world" type.

6

SYSTEMIC ONTOLOGY AND HEIDEGGER'S ONTOLOGY: A DISCUSSION ON SYSTEMS AND $\lambda\acute{o}\gamma o\varsigma$

Elena Bartolini

Systems thought is essentially based on recognizing the existence of structural relations but, from the philosophical point of view, there are no accounts about this particular and specific topic. In my paper I would present a proposal focused on some elements from Heidegger's ontology in comparison with a systemic one, in order to provide some contents for this issue. I'm especially focusing on the interconnection between the Greek and Aristotelian terms $\varphi\acute{\upsilon}\sigma\iota\varsigma$, $\lambda\acute{o}\gamma o\varsigma$ and $o\nu$, conceived within the Heideggerian interpretation, to display how incompleteness and openness are required for the development of a systemic ontology, with even important consequences in a systemic approach to the human being.

7

THE PROBLEM OF FUNCTIONAL BOUNDARIES IN PREBIOTIC AND INTER-BIOLOGICAL SYSTEMS

Leonardo Bich

The concept of organisational closure, interpreted as a set of internally produced and mutually dependent constraints, allows understanding organisms as functionally integrated systems capable of self-production and self-maintenance through the control exerted upon the exchange of matter and energy with the environment. One of the current challenges faced by this theoretical framework is to account for limits cases in which a robust functional closure cannot be realised from within. Hence, in order to persist, prebiotic or biological systems need to recruit external constraints to achieve a form of functional sufficiency. This paper will analyse from an organisational perspective the role of environmental scaffolds and of different classes of intersystem interactions in prebiotic and supra-organismal biological scenarios.

8

A NOTE ON BASIC ASPECTS OF ECONOMIC ORGANIZATIONS AND SOCIAL SYSTEMS

Lucio Biggiero

Exaptation is a concept developed into the field of evolutionary biology, later rediscovered within economics and management sciences. It refers to a situation in which a sub-system intentionally or spontaneously created for a given purpose is acknowledged to be employable also for another (unpredicted) aim. This paper revisits the issue of exaptation by pointing at various cases: whether the original purpose was serving an internal vs. an external function, whether it was a redundant or an essential resource, and then by focusing on exaptation consequences in terms of potential qualitative redundancy of the system (without increasing system's size) respect to the traditional concept of quantitative redundancy. This issue of qualitative redundancy will be more deeply investigated, because it determines a considerable increase of a system's capacity to face with internal or external complexity, namely, a system's adaptability, resilience and evolvability.

9

THE USE OF BRAIN COMPUTER INTERFACES (BCI) COMBINED WITH SERIOUS GAMES FOR PATHOLOGICAL DEPENDENCE TREATMENT

Natale S. Bonfiglio, Roberta Renati, Eliano Pessa

Many types of video games have already been developed on the market, and the use of serious games is also spreading more and more, e.g. for educational and learning aims (Connolly, 2012; Charsky, 2010), for prevention and rehabilitation (Wiemeyer e Kliem, 2011), or for therapeutic purposes related to several mental or cognitive disorders (Santamaria et al., 2011).

A Brain Computer Interface (BCI) is a technology that translates the EEG activity in electric signals to control external devices. It has been used together with serious games. Started with the intent to help people with motor problems to use software or PC (Curran et Strokes, 2003), this technology has increasingly diversified its uses from the original one.

There are, in fact, several example of BCI devices use for clinical purpose with specific training tools like that for chronic stroke (Buch et al., 2008) or Parkinson patients (Turkoni et al., 2014).

This contribution presents an example of BCI training tool designed for therapeutic purposes related to addicted patients, with positive outcomes, like self-efficacy and coping strategies enhancement, and its perspectives are encouraging for the future.

Even if it seems correct to hope in an increasingly widespread and specialized use of the BCI technology, combined with serious games, this leaves open some questions about the effective mechanisms (cognitive, neuropsychological etc.) that lead to positive therapeutic outcomes. In that context the human-machine interaction is a typical case of interaction between two quasi-systems, given the intrinsic variability both of the stakeholders and the nature itself of the interaction.

10

NEED FOR A "SYSTETICS"

Giordano Bruno

Taking in consideration the systemics as a paradigm of the thought represented in the "Theory of the systems" by Von Bertanlaffy, it is possible to analyse that this concept is proceeding in a multidirectional walk with the purpose to promote a new approach to the reality, which overcome all its reductionists aspects, that for their limits, have impeded a vision of it. Thanks to the 90's century analyses coined from the scientific revolutions, this new approach to the reality, which emerges in the relationships of every nature that characterize our lives, gives the possibility to investigate, understand and operate in a hyper complex world. In the years when I was interested and I promoted and developed my education at a Design Training Institute, I realized that this term should be integrated (and could be) with two other aspects that convey the relationship between humans, and between themselves and what is out of them. These are aesthetics and ethics, so I coined the term "Systetics" (Sistetica).

11

AN EXAMPLE OF QUASI-SYSTEM IN THE GENERATION AND TRANSMISSION OF ELECTRICAL POWER

Umberto Di Caprio, Mario R. Abram

Let us consider an electrical power system constituted by two electrical machines mutually connected. In presence of perturbations an instability arises

due to which an electrical disconnection comes into evidence even if the system is physically connected. The system saves the same physical structure while it loses the electrical connection giving place to the separation of the original system into two separate subsystems so that we can say that the original system is a quasi system.

12

THEATRICAL ORGANICISM: THOUGHTS ON DRAMA AND SYSTEM THEORY

Francesco Dossi

What are the constitutive elements of drama? In this innovative analysis of theatre history through the lens of system theory, this paper shows how this approach can support the idea of an intrinsically relational nature of the theatre praxis itself, its genesis and the origin of modern dramaturgy, meaning the act of organizing the various elements of a mise-en-scne, both on and off stage. The aim of this research consists also in showing that what we call drama is an emergent property that is generated by the connection between the actors and the audience.

13

EMBRACING THE UNKNOWN IN POST-BERTALANFFY SYSTEMICS COMPLEXITY MODELING

Rodolfo Fiorini

Human beings' approach to the real world is about incompleteness: incompleteness of understanding, representation, information, etc. It focuses on the unknown, rather than on the production of mathematical certainties based on weak assumptions. The human brain is at least a factor of 1 billion more efficient than our present digital technology, and a factor of 10 million more efficient than the best digital technology that we can imagine. The unavoidable conclusion is that we have something fundamental to learn from the brain and biology about new ways and much more effective forms of computation and information managing. The presented approach, based on CICT, has shown to be quite helpful with high application flexibility. It can be applied at any system scale and open the door towards a more effective post-Bertalanffy Systemics Complexity modeling, taking into consideration system incompleteness, quasiness, and beyond.

14

ARCHITECTURE AND SYSTEMICS – PERFORMANCE REVISITED

Carlotta Fontana

The word "performance" entered the world of architecture when industrialization took command of the building industry, through industrial design. The idea of performance links together the users' needs and the requirements an artifact must possess to satisfy those needs. In the industrial design process, a long sequence of requirements defines the product fitness for the purpose it is designed and produced. Optimization is the ultimate goal of any industrial process, and optimization became a keyword in architecture when the theory of rational design – for many historic reasons – approached the theory of architectural design. Architectural design deals with many different scales of artifacts: "from the spoon to the city" once was a popular slogan to define the modern architect's professional domain. The functional notion of "performance" can easily and correctly be applied to an object, a device, a machine; it may be useless, and even dangerous, when it is applied to a living space, and the more so as the space grows bigger. When we talk about the built environment, which results from the never-ending activities of generations over time, where people live and act continuously, the idea of "functional optimization" sounds ludicrous. Yet, the relationship between the "users" – people, communities, human groups and single beings – and the places that sometimes architects give form to, still requires appraisal and some form of operational definition.

15

SENTENCES AS SYSTEMS. THE PRINCIPLE OF COMPOSITIONALITY AND ITS LIMITS

Aldo Frigerio

In this paper, it is argued on two different grounds that sentences in natural languages can be seen as systems. First, beyond their linear order, sentences exhibit a syntactic hierarchical structure. Therefore, they are structured entities. Second, although the principle of compositionality – which states that the meaning of a sentence is a function of the meanings of the parts of that sentence – is valid in general for natural languages, this principle has been shown to have many exceptions, where interpretation does not proceed bottom-up but

top-down, from the meaning of the whole to the meaning of the parts. If the whole depends on its parts and the parts on the whole, then the sentence is a system that cannot be dissected into separate parts without losing something essential.

16

ALL THE SHADES OF INCOMPLETENESS: THE SINGULAR CASE OF STRUCTURE / FUNCTION RELATIONS IN BIOCHEMISTRY

Alessandro Giuliani

The quest for relevant correlation between chemico-physical properties of molecules and their biological activity is a unique vantage point where to look at the rising need of "deliberately incomplete" models at both increasing complexity of the modeled systems (from small organic molecules to proteins passing by peptides) and level of detail of the functional end-point (from receptor binding to pharmacological activity).

While the golden rule "the more complex (i.e. more near to biology and the more distant from chemistry) the more coarse must be the approach" has no exception, it is not easy to immediately locate a particular problem along the complexity axis. Thus very strictly constrained application domains (e.g. very homogeneous chemical series) allow for relatively refined quantitative models even for predicting complex biological end-points, while in the same time apparently "largely non-biological" properties like protein flexibility ask for deliberately coarse grain models.

The long story of Quantitative Structure-Activity Relationships (QSAR) in pharmacology and toxicology gives us some enlightening examples of the relevance of the context and of the particular question we ask to Nature in determining the most efficient modeling grain in terms of predictivity.

17

ARE DYNAMICALLY UNDECIDABLE SYSTEMS UBIQUITOUS?

Marco Giunti

One of the main tenets of Wolfram's *A New Kind of Science* is the Principle of Computational Equivalence (PCE): "Almost all processes that are not obviously simple can be viewed as computations of equivalent sophistication"

(2002, pp. 716-717). PCE, together with the seemingly uncontroversial premise that the behavior of a computationally universal system is not obviously simple, entails that computationally universal systems should be ubiquitous, for they would almost coincide with the very many systems that display some form of complex behavior. A further consequence of this fact is that dynamically undecidable systems should be ubiquitous as well, for it is well known that the long term behavior of any computationally universal system is in general undecidable (consider for instance the halting problem, and related undecidability results).

In this paper, I propose an independent argument for the ubiquity of computational universality and, as a consequence, dynamical undecidability as well. My argument does not presuppose PCE and, in essence, goes as follows.

In the first place, I present a series of relevant facts. (i) Computationally universal systems are a special kind of computational systems, which in turn can be thought as a special kind of discrete deterministic dynamical systems; (ii) the property of computational universality is based on the relation of emulation between dynamical systems, which is a quite weak structure preserving mapping from the state space of the emulated system to the state space of the emulating one; (iii) the relevant state space structure preserved by such a mapping reduces to the transition graph of the emulated system that, for any discrete time dynamical system, in turn reduces to the graph of its transition of duration 1 (1-step transition graph); (iv) like any graph, the state transition graph of any dynamical system exhaustively decomposes into a set of internally connected and mutually disconnected components; (v) for any discrete time dynamical system such components are of just five mutually disjoint and exhaustive types (Classification Theorem); (vi) for any computationally universal system, the problem of deciding the type of the component to which an arbitrary state belongs is undecidable (undecidability of the classification problem).

On the basis of these facts, I argue that (vii) the classification theorem ensures a strong structural similarity between the 1-step transition graphs of any two discrete-time systems; (viii) therefore, reproducing the dynamics of an arbitrary discrete-time system does not seem to require a system with especially unusual or extraordinary features; (ix) in addition, it must be kept in mind that the structure preserving mapping needed for universality is emulation, which is itself quite weak.

I finally conclude that, given (vii), (viii) and (ix), computational universality might very well hold under very weak conditions, so that computationally universal systems, and dynamically undecidable ones as well, might be much more widespread than thought before.

18

DYNAMIC SYSTEMS AND RELATIONSHIP WITH MOVEMENT, TRAINING AND PAIN

Carlos Guerra Nieto

The topic of the discussion will deal about the movement based on the concept of the human being as a dynamic system, that continuously adapts to the relationships that establishes and generates with the surrounding environment and learns and relates through the latter. The term "complex" reports that the adaptive answer is modulated according by multiple biopsychosocial variables. The theory of the Complex Dynamic Systems is fundamental in order to understand the close relationship between three components that make the movement possible in one way or another: STATE OF THE SYSTEM, SURROUNDING ENVIRONMENT, TASK. For these reasons the training adaptations, will be influenced by aspects as:

– The stress suffered by the tissues (bio).

– The argument with the girlfriend or boyfriend before the training (psycho).

– The win versus the training mates doing push-ups (social).

The state of the system refers to the motor skill perceived by the system in that moment. The level of effort, the stress of the tissues or the emotional state, for example, will determine which possible neuromuscular settings are evaluated by the system as alternatives to achieve the success in the task proposed. The neuromuscular settings will be created on the basis of the alternatives that the motor system is able to dominate and of the direct relationship with the motor memory (previous similar experiences and grade of success). The task will mark the objective and the focus of attention. The characteristics will determine different movement possibilities that the system proposes as possible solutions in order to achieve a single goal, within the motor capabilities that can be generated in that moment. The information that arrives from the surrounding environment, at proprioceptive, visual, vestibular and auditory level, will filter more and more these possibilities, putting them one on the other, on a preferences scale to solve that concrete problem, in that specific environment, in that determined moment. The continuous feedback of the three elements causes that the system finally establishes the neuromuscular sequence with the highest probability of success and that auto-organize itself to give the best possible answer, the more efficient in relation with the information that perceives. The system will observe the result and will learn in order to give a better and faster answer in the future. In this context, we will deal about the pain under a systemic perspective: there will be the presentation of scientific articles that find out a non-existent link between structure and pain and will be showed conclusions regarding the reasons why the brain produces pain.

19

THE QUANTUM QUASINESS FROM BOHR TO THE BELL LOOPHOLE TESTS

Ignazio Licata

Quantum physics has since its formulation been a place of strong conceptual clash on the meaning of terms such as uncertainty, incompleteness, status description, probability, and so on. This has produced a long debate on the conceptual foundations of the theory that from Bohr vs. Einstein until today has not found a solution. Here we want to frame the historical and philosophical terms of the issue and point out some inedited solutions that the experiments and the new theoretical formulations seem to indicate to get out of the old stalemate of "realism".

20

THE IDEA OF INCOMPLETENESS IN THE INTERNAL REALISM OF HILARY PUTNAM

Antonio Lizzadri

The ambitious project of the second Systemics of defining the structural dynamic of becoming reopens the great questions over the consistency of reality and the possibility of knowledge. Among the recent proposals of contemporary philosophy inside the debate around realism, the "internal realism" of Hilary Putnam seems to offer an adequate theoretical model to satisfy such requests. This paper will delve into the semantic of Putnam that is rightfully possible defining "quasi-systemic" since not only it recognizes the meaning as emerging property and irreducible to the natural and social "semantic indicators" that is constituted of, but also because it does not forecast to determine *a priori* a hierarchy of the same. Then, we are going to consider that Putnam does not interpret such incompleteness as indeterminacy of the reference, but as complementarity between the theory of meaning and the theory of understanding, reason of the recognition of the interdependency between the prospective of the observer and the one of the participant. In other words, the definition of the meaning is always going to be part of a linguistic procedure in which the anthropological complexity of the speaker plays a crucial role. In this sense, the essence of the incompleteness will really show itself as freedom.

21

THE PSYCHOPATHOLOGICAL PROCESS AS A SYSTEM OF DYSFUNCTION AND SYSTEMIC COMPENSATION WITH TOP-DOWN MODULATION

Pier Luigi Marconi, Maria P. Penna, Eliano Pessa

In agreement with a systemic approach to mental illness, it is possible to detect 5 components in the pathogenesis of a psychiatric disorder: overload / subjective discomfort, relational disorders / social disorder, loss of emerging functions, appearance of less adaptable primary functions, activation of top-down reactions with the emergency of compensatory activities of collateral systems (Marconi PL: "La malattia mentale nella prospettiva sistemica". *Rivista di Filosofia Neo-Scolastica*, 3 (2014), pp. 561-587).

At the base of these processes it could be the reduced integration of a subsystem, which would lead to the loss of flexibility of the entire mind system, with the appearance of the five psychopathological components described above.

To confirm this hypothesis we have observed data got from some studies performed with high-density EEG recording during neuropsychological tests. In these studies, subjects with a history of maltreatment (having problems in error management, meaning attribution, and social relations) resulted in a different brain integration than controls, with a reduction in the level of integration in some areas and with an appearance of new integrations in different areas; at the same time, behavioral response tends to extend over time with late aware operations, corresponding to the time window of the LPP event related potential (450-1000 ms), while controls seem perform quicker evaluations, in the time windows of the P3 wave (250-450 ms).

Differently from control subjects, maltreated people have a greater difficulty also in distinguishing non-significant stimuli and in inhibiting unnecessary responses, although the presence of a warning stimulus supports the strengthening of the self-control functions.

These responses would therefore confirm the reference theoretical model, as the loss of integration of some brain areas results in a loss of efficiency in the cognitive performance with less mind control in the responses. The possibility to reach comparable performances with those of control subjects seems to relate to a different resource use (collateral compensation) and to a greater consequent response delay (loss of efficiency).

The presence of a collateral compensation may be explained with the presence of top-down modulation functions of emerging properties, which in the specific case may be represented by conscious mental activities and by the need for warranting congruity with the external request.

22

A SYSTEMIC APPROACH TO POLITICAL AND RELIGIOUS COMMUNICATION: TWO CASE STUDIES

Irune Medina

Decision making is not easy. Very frequently, it's not even rational! Every day we are witness of choices, both individual and collective, that seem to escape all logic. Especially when the choices emerge from the specific ways of discursiveness: marketing, advertising, propaganda, religion, education, science, etc. The paper addresses a problem of practical relevance in many applicative domains: How is decision making realized by people when others' subjective interpretations are in contradiction with their own perception of reality? We argue that there are non-cooperative uses of language (a kind of "dark side") that prompt individuals to take decisions based on opaque, when not inconsistent, assumptions. These choices, however, often come into conflict with what can be considered as viable for the individual, thus turning language into a powerful social manipulation tool. Understanding how language becomes a social manipulation tool would indeed help shed light on a variety of key processes in societies. Given the highly complex nature of language and communication that entails the emergence of new levels of signification as a consequence of the communicative and operational interaction of social agents, we rely on a conceptual framework that allows to deal with the different components and mechanisms (biological, cognitive and social) that play a key role in social communication. To do so we deploy a conceptual tool, i.e. a systemic model of communication (more precisely a meta-model), that takes into account the multi level, emergent and interactive nature of social communication based on the methodological approach of the Dynamical Usage of Models. This latter turns to be very valuable especially when one is required to model complex phenomena, thus highlighting the emergent features of the interactions between their different components. Using this meta-model, we are able to identify, describe and understand the different cognitive mechanisms that occur in the social communication process. The proposed meta-model leverages on the mechanisms of perceptual learning and categorical perception, radical constructivism, game theory, neo-rhetorics, decision making to provide a picture of the complexity hidden in the decision making processes that social communication involves. By applying our model to the self-legitimation speech of Naasón, Leader of the mexican cult "La Luz del Mundo" we develop a qualitative analysis to see how a religious belief system relies on language in cooperative and competitive terms and to understand how this helps define its organizational identity, existence and growth. Our modeling approach is not the only possible way to address the problems related to social communication. Notwithstanding this, we believe that our approach is well

suited to bring together the variety of features that most of the time, in social studies, are analyzed in isolation, thus providing a conceptual framework for the development of new social decision making tools, regardless of the application domain.

23

DOES SYSTEMICS STILL NEED THEORIES? THEORY-LESS KNOWLEDGE?

Gianfranco Minati

Understanding may be considered as being related to the availability of effective theories allowing for effective predictions and interventions. Formalisations of theories allow modelling and simulations. However, approaches such as connectionism, network science, sub-symbolism, and evidence-based methods, have accustomed us to accept and use approaches without full comprehensive formal explanations, such as for the ubiquitous phenomenon of emergence. We are increasingly accepting the use of concordances, redundancies, transversal properties (e.g., power laws and scale invariance), and simulation properties as clues to be confirmed, as for induction, by their high frequency occurrence. This may be considered to be related to the availability of enormous amounts of data in conceptually data-driven frameworks, where data driven means retrospective clustering. We discuss whether systemic understanding should be considered as ideal, formal understanding or concordance-based.

24

ON SOME OPEN ISSUES IN SYSTEMICS

Gianfranco Minati

The purpose of this contribution is to list some current, advanced systemic issues whilst searching for suitable, possibly theoretical, approaches. As is well known the peculiar aspect characterising systemics is considered to be the process of acquisition, by collective interactive, interrelated constitutive elements, of properties different than those of the constituent elements themselves. We consider whether the peculiarity of acquiring a property is attributable only to systems, that is, to their processes of interaction among their constituent elements. We consider some elementary examples where the mechanism seems to be different, such as capillarity, composition of properties, density variations, optical properties, percolation, phase transitions, Quantum Field Theory, and the sloppiness of models. The mystical expression "the whole is more than the

sum of its parts" could be dealt with in different ways, even within the constructivist role of the observer. We consider how some current systemic issues could take advantage of the adoption of new unconventional approaches, such as the ability to act on phenomena of emergence; the need to have suitable network representations for some primary systemic properties, e.g., adaptation and logical openness; theory-less systems based on concordances in Big Data (are they still systems?); incompleteness and quasi-systems. We consider the difficulties in applying systemic approaches to human societies which may often not be reducible to social systems.

25

CONNECTIONS AND DISSIMILARITIES AMONG FORMAL CONCEPT ANALYSIS, KNOWLEDGE SPACE THEORY AND COGNITIVE DIAGNOSTIC MODELS IN A SYSTEMIC PERSPECTIVE

Eraldo F. Nicotra, Andrea Spoto

In the early eighties of the last century three theories were independently developed in the fields of information science, mathematical psychology and cognitive psychology. In 1982 Rudolph Wille conceptualized a a principled way of deriving a concept hierarchy from a collection of objects and their properties: the Formal Concept Analysis (FCA). Such representation draws upon the order theory developed almost fifty years before by Birkhoff. In 1985 Jean Claude Falmagne and Jean Paul Doignon, starting from the 1937 Birkhoff theorem about the one-to-one correspondence between distributive lattices and partial orders, develop a theory to represent the prerequisite relations among sets of problems in the field of knowledge assessment: The Knowledge Space Theory (KST). In 1983 Kikumi Tatsuoka introduced the concept of a Q-Matrix defining the basis for the development of a skill based way for cognitive diagnosis: The Cognitive Diagnostic Models (CDM).

Although a number of differences characterizes the three approaches, they all share a number of elements from both the deterministic and the probabilistic point of view. It is an interesting issue how, so far, only few attempts to highlight similarities among the theories have been carried out.

This research, within a systemic perspective, is aimed at pinpointing some of the main deterministic and probabilistic concepts that, even if named differently, are shared by the three theories. More specifically, the connections between the Fomal Context (FCA), the skill-map (KST) and the Q-Matrix (CDM) are discussed and the possibility of passing from one to another is described. The formal and applicative consequences of such reformulation are explored.

26

VALUES FOR SOME. HOW DOES CRIMINAL NETWORK UNDERMINE THE POLITICAL SYSTEM? A DATA MINING PERSPECTIVE

Roberto Peroncini, Rita Pizzi

The topic of this work is the dilemmatic situation emerging from the relationship between Economics of Crime and Political System.

If a complex system as the Criminal Network cannot be totally grasped by the Rational Theory Choice; if its total system of value is functionally equivalent for the General Theory of Politics, it is necessary to review both in the light of other theoretical systems. And since the two Theories are based on a concept of Equilibrium which does not remedy the complexity of situations involving planes of infinite possibility, it is necessary to replace it by another one that does not allow the same problems.

The question slots into a central knot in which inevitable conflicts, edifying intersections between Individual Action and Increasing Complexity, Data Mining and SNA Techniques are produced.

27

MUSIC: CREATIVITY AND NEW TECHNOLOGIES. A SYSTEMIC APPROACH TOWARDS MULTIMEDIA PROJECT AND SOUND DESIGN

Emanuela Pietrocini e Maurizio Lopa

Representations of musical phenomenon in contemporary production include extremely various and apparently inhomogeneous expressive fields: forms, contents and styles increase and blend together; they stop having their connotative function and situate themselves at a level of description which, from a systemic point of view, could be defined as meta-structural.

In fact, the creative production moves towards the syncretism: sound, image, environment and language are equal and interactive parts of a synestethic process of which it is possible to trace creation and enjoyment in the same role of observer.

Modern technologies provide sophisticated and powerful instruments which enable a highly refined manipulation of the sound and multimedia material.

Today, a creative person has almost unlimited resources but, mainly due to a tension aiming at mass communication, there is the risk of becoming a mere repetition of established patterns with formulas that are not always captivating.

A systemic approach towards multimedia project and sound design, restores the identity to the creative process, allows to identify interactions and network connections among elements and systems of elements according to a non-linear, open, non-deterministic and non-finalist model; yet, it is incredibly effective since the representation of coherences, defining the artistic product, is also the representation of shared thinking and beauty.

28

ON THE COMPLEXITY OF BAROQUE MUSIC AND IMPLICATIONS ON ROBOTICS AND CREATIVITY

Andrea Roli

In this paper we propose a perspective of baroque music as a phenomenon emerging from the interaction between a set of instructions (the score) and a frame of constraints in which to apply the instructions (the performance practice). This perspective provides a more principled setting for addressing the issue of estimating music complexity and suggests new ways towards artificial creativity through incompleteness. The considerations we elaborate on baroque music are extended to other complex processes, such as robotic behaviour.

29

A VIEW OF CRITICALITY IN THE ISING MODEL THROUGH THE RELEVANCE INDEX

Andrea Roli, Marco Villani, Roberto Serra

The Relevance Index has been introduced to detect key features of the organisation of complex dynamical systems. It is based upon Shannon entropies and can be used to identify groups of variables that change in a coordinated fashion, while they are less integrated with the rest of the system. In previous work, we have shown that the average Relevance Index attains its maximum at the phase transition in both Ising model and random boolean networks. In this contribution we present a further study on the Ising model, showing that the relevance index is maximised for large groups of variables at criticality. These results provide further evidence to the hypothesis that this index is a powerful measure for capturing criticality.

30

NATURAL RATES OF TEACHERS' APPROVAL AND DISAPPROVAL IN ITALIAN PRIMARY AND SECONDARY SCHOOLS CLASSROOM

Francesco Sulla, Usebia Armenia, Dolores Rollo

Since the 1960s, researchers have been demonstrating the power of teacher approval on the behaviour of students. Despite the huge amount of research in English-speaking countries the natural rates of approval and disapproval had never been investigated in Italian schools.

The aims of this study were: (a) to examine the proportionality of different types of verbal feedback used by teachers; (b) to examine the relationship between teachers use of verbal feedback and the behaviour of students. A total of 314 observations in schools were conducted. As regards teacher verbal behaviour: we found that both approval and disapproval rates per minute declined and neutral verbal behaviour (instructions, expositions, explanations) increased as the age of the pupils increases. There was a clear difference between primary school and secondary school teachers.

31

AI-CHATBOT USING DEEP LEARNING TO ASSIST THE ELDERLY

Guido Tascini

Recently "Bot" and "Chatbot", both Artificial Intelligence software systems, have appeared online. These create a conversation between a virtual agent and the user. This paper describes an Artificial Intelligent Chatbot conversing with elderly persons, with age-related problems.

Chatbot: understands natural language and learns from interactions, increasing his knowledge; remembers commitments and medicines, connects remotely with doctors, family; controls transmission of physiological parameters; entertains the elder.

Do this with machine learning algorithms. In order to learn functions with high-level abstractions , as Natural Language, we adopt deep architectures: composed of multiple levels of non-linear operations, such as neural nets with many hidden layers.

We used the recently optimal learning algorithm (DBN) proposed by Hinton et al.. Experiments confirm its optimal training strategy, by initializing weights in a region near local minimum.

32

TEMPORAL AMBIGUITY: MUSIC BETWEEN COHERENCE AND INCOMPLETENESS

Martino Tosi

In musical compositions there is a strong relationship between coherence and incompleteness. While some models (like the theoretical approaches of Schenker and Schoënberg) allow to understand the structural coherence and unity of a passage, some others (like the Meyer's one) show how the temporal evolution of a piece is ambiguous and therefore open to interpretation and subject to emerging and unexpected developments, creating perturbations that, thanks to subsequent advancements of music, are able to find harmonization with the whole. Therefore, each and every model proposed for the study of a complex composition is incomplete. The score itself is only to be considered as an abstract code that has to be realized by the interpreter, who creates every time new processes of emergence.

33

ECONOMY AND QUANTUM THINKING

Francesco Zanotti

Present economic theories are founded on the way of thinking of classic mechanics. In fact, for example, economists try to find the "laws of economy".

Up to present days this research program has failed. In fact there are competing macro-economic frameworks, none of which is satisfactory. Micro economy has almost nothing to do with macro economy. The search for equilibrium of the micro economy leads to the discovery that there are infinite possible equilibria. Last but not least, we do not have a theory of entrepreneurial behavior. I tried to change the point of view of present economic theories using the quantum way of thinking instead of the classical one.

First of all I found other people that have used quantum thinking (gauge framework) in finance and economy: from physicists to practitioners in financial markets.

Then I tried a "major jump": adding to quantum thinking the autopoietic thinking. I developed a theory of entrepreneurship and of the self-evolution of economic actors (firms), industries as weel as the economy as a whole.

After that, I tried to propose a new way of governing the self-evolution of firm, industries and economies.

ACTIVITY OF THE EUROPEAN UNION FOR SYSTEMICS (EUS - UES)

Gianfranco Minati, President-elect 2014-2017

Evelyne Andreewsky (Died in 2007), PhD in Computer Science (Neurolinguistic Modelling), from Pierre & Marie Curie University, Paris VI, was Senior Researcher at the French National Research Institute I.N.S.E.R.M. She was founder and honorary president of the Union Européenne de Systémique – European Union for Systemics (UES – EUS).

The Union, founded in 1988, aims at promoting European research and practice of systemics. The UES-EUS is a community of national scientific societies. The UES-EUS seeks to establish, through its network of companies, a favourable environment to the evolution of systemics (including its theoretical foundations, its methods and its implementation) and its diffusion, in particular by promoting transdisciplinary exchanges.

The Activity of the UES-EUS

- 1st Congress: 3-6 October 1989 in Lausanne (Switzerland) organized by AFSCET (Association Franaise pour la Cybernétique Economique et Technique) with the support of the University of Lausanne, HEC-Inforg (Institute of Information and Organization).
- 2nd Congress: 5-8 October 1993 in Prague (Czech Republic) organized by the "Science and Information Systems" of Czechoslovakia and the College of Systemics of AFSCET with the support of the European Communities.
- 3th Congress: 1-4 October 1996 in Rome (Italy) organized by AIRS (Associazione Italiana per la Ricerca sui Sistemi) and ECONA (Interuniversity Center for Research on Cognitive Processing in Natural and Artificial Systems) with the support of the University of Rome "La Sapienza".
- 4th Congress: 20-23 September 1999 in Valencia (Spain) organized by the Society SESGE, with the support of "SECL Fundaciò Five Secles" of the University of Valencia and the Generalitat de Valencia.
- 5th Congress: 16-19 October 2002 in Crete (Greece) organized by the Greek Association of systemics (Hellenic Systems Society) together with a symposium of the European Association for Family Therapy and the support of national and local authorities.
- 6th Congress: 19-22 September 2005 in Paris (France) organized by AFSCET (Association Française de Science des Systèmes Cybernćtiques, Cognitifs et Techniques).

- 7th Congress: 17-19 December 2008 in Lisbon (Portugal), organized by the Portuguese Association of systemic APOCOSIS (Associaçao Portugesa de Complexidade Sistémica).
- 8th Congress: 19-22 October 2011 in Brussels, organized by S&O (Systèmes & Organisations) the Belgian affiliate. Congress' theme "Systemic approach of diversity: from knowledge to practise – from practise to knowledge".
- 9th Congress: 15-17 October 2014, in Valencia (Spain). Congress theme "Globalization and Crisis. Complexity and governance of systems".
- 10th Congress: 15-17 October 2018, in Brussels (Belgium). Congress theme "A systemic vision of the crises". http://ues2018.eu/en/a-systems-thinking-approach-of-crises-from-optimization-to-change-strategy/

A SYSTEMIC VISION OF THE CRISES

Although raised many times on other congresses, the theme of crisis is still not depleted.

Indeed, questions related to visible effects of crises emerge in all human activities (economy, politics, culture, education, security, architecture ...).

A lot of measures urgently correct the visible symptoms of problems without trying to understand the underlying logics linked to them. Yet, crisis is a multidimensional societal phenomenon that cannot be reduced to immediate consequences.

In response to these topical issues, corrective actions can be taken in order to re-establish existing structures.

However, answers provided are often (in)efficient and are over the short term. Indeed, these answers do not propose a strategic purpose that could lead to a coherent, long-lasting and sustainable development.

More than ever, a system-based approach of the process through which crisis – in its various forms – emerges is essential in order to act with full awareness of the interdependence of the phenomena under study.

The change required is of structural nature rather than parametrical.

Beyond analytical apprehension of mere causes, the systems thinking approach is an efficient tool in order to model systems, identify complex factors, describe elements and their relationships.

Then, this strategic purpose will lead to actions which will have structural and long lasting impacts.

Topics for the Congress

The main topics will be:

- systemic modelling of crises processes;
- identification of crises types and factors;
- systemic interventions on crises;
- political crises and governance;
- growth and development, durability and sustainability;
- concept and representation of crises through various disciplines;
- historical context of the emergence of the crisis concept;
- adaptation and transformation;
- economic crises;
- housing crises and precariousness;
- family unit in crises;
- prevention and crises solving;
- crises resources;
- ...

Keywords: complexity, crisis, emergence, post-industrial, sustainability, systemic, change, strategy, digital

SESSIONS

Call for proposals: sessions / workshops.

Submissions before 31th December 2017.

The Organizing Committee of the 10th Congress of the European Union for Systemics (EUS) is launching a call for proposals for sessions and workshops for the Congress titled "A systemic vision of the crises" (UES-EUS2018).

The sessions and workshops establish a shared thematic understanding that promotes cross-disciplinary collaborations. They offer participants the opportunity to exchange ideas on different themes, present results, and they also give the opportunity to share experiences, identify issues and / or explore future directions for research and practice.

- A session usually counts between 4 and 6 contributions of 20 minutes each. Contributions lead to articles.
- A workshop usually lasts 2 hours and is organized from more dynamic events (guest speakers, panels, forums, experiments, role plays ...).
- Special sessions and / or workshops requiring more time may be considered depending on the availability in the program.
- To submit a session or workshop proposal (in English or in French), please:
  - propose a title (not too long)
  - identify the main contact person (names, e-mail address)
  - indicate the identity of the person / people in charge (names, e-mail address, postal address, mini-biography)
  - define the theme in a maximum of 600 words (the theme, the posture, the motivations)
  - estimate the extent of the session (time, number of interventions)
  - estimate the expected logistical resources (type of room, room size, projector ...)
  - optional: information about the previous edition of the session at another event.
- All proposals for sessions and / or workshops must be submitted by e-mail as an attachment (ues2018@ues-eus.org) , format *.doc, by 31 December 2017.
- Proposals will be reviewed by at least three members of the Scientific Committee. They will be evaluated according to their relevance for the UES-EUS2018 congress and its participants, the breadth and depth of the proposed subject, its topicality and objectives, the quality of the participants and the logistical feasibility.
- When a proposal is approved, at least one of the officers must commit to assisting and facilitating the session or workshop which he or she (co)organizes professionally and ethically, respecting the program, the spirit and the activities of the UES-EUS2018 congress.
- The sessions and workshops are an integral part of the UES-EUS2018 congress. The documents accepted by the Scientific Committee will be published in the journal *Acta Europeana Systemica* (AES), n. 8, 2018.