2014

Civilisation at the Crossroads Response and Responsibility of the Systems Sciences

Book of Abstracts

BCSSS

European Meetings on Cybernetics and Systems Research

Jennifer Wilby, Stefan Blachfellner, Wolfgang Hofkirchner (Eds.)

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EDITORIAL COMMENT
Book of Abstracts EMCSR 2014

We are proud to present the Book of Abstracts for the 22nd European Meetings on Cybernetics and Systems Research.

Since 1972, the European Meetings on Cybernetics and Systems Research (EMCSR) have been held in Austria every two years. They were organised by the Austrian Society for Cybernetic Studies (OSGK) founded in 1969 (which established a special institution, the Austrian Research Institute for Artificial Intelligence (OFAI), in 1984, in cooperation with organisations such as the Department of Medical Cybernetics and Artificial Intelligence, University of Vienna, and the International Federation for Systems Research (IFSR).

The latest meeting is organised by the Bertalanffy Center for the Study of Systems Science (BCSSS) in co-operation with a number of other organisations in the field – as the Ukrainian Synergetic Society, the World Organisation of Systems and Cybernetics, the Union Européenne de Systémique, the International Academy for Systems and Cybernetic Sciences, the International Society for the Systems Sciences, the Institute for Design Science Munich, with the support of the International Federation for Systems Research (IFSR) and the Vienna University of Economics and Business (WU) under the patronage of the Mayor and Governor of Vienna from 22nd to 25th of April, 2014.

The 2014 meetings are again open to any researcher and practitioner in the field, be it systems biology or information systems, complex adaptive systems or sociocybernetics, evolutionary economics or ecosystems research, systems philosophy or constructivism, self-organisation or cognitive science, network theory or artificial intelligence or any other specialisation that is rooted in cybernetics, systems theory or complexity theory.

Systems terminology has entered any field of society – everyday practice as well as research and development in the sciences, be it in natural, social or engineering sciences or in logics and mathematics or in philosophy. All of those sciences that revolve around systems shall, and do, contribute, in one way or another, more or less, to the thriving of civilisation. But how do they perform now that global challenges beset civilisation as never before? Our world is at crisis. Global challenges abound. However, they have a “dark” and a “bright” side. The dark side is the imminent danger of the breakdown of interdependent societies with the perspective of extermination of civilised human life. The bright side marks a possible entrance to a new stage of evolution of humanity, to the self-organisation of a humane world society.

Cybernetics, systems research, the sciences of complexity – all of them have the potential to endow the subjects of history with guidance and a means for mastering the current transformation. But the readiness of cybernetic, systems and complex thinking for the tasks ahead has to be continuously reassessed and improved. The time has come to reflect on the aims, the scope and the tools of a multitude of approaches. Platforms for the self-understanding of the whole field are needed now more than ever. “Best practice” has to be redefined. This is the agenda of the EMCSR 2014 “Civilisation at the Crossroads – Response and Responsibility of the Systems Sciences”.

Thus the meetings focus on the the self-understanding of the field, in particular, on (1) illuminating the underlying assumptions that make approaches distinct from each other or are shared by them while (2) questioning the impact on society.

In particular included topics critically assess the tools, the scope and the aims of systems sciences:

- What are the particular concepts and foundational assumptions by which we approach real-world problems?
- Can we discern concepts and foundational assumptions that better suit a problem at hand? If yes, do we realise that our civilisation is in a deep crisis? If yes, do we realise that this crisis is a systemic one? If yes, how do our particular approaches respond to the crisis? What are the foundations that are needed to help us overcome the crisis?
- Do we accept responsibility for our findings? If yes, do we share the responsibility for the applications of our findings? If yes, do we share the responsibility for the fate of our civilisation? If yes, can we evaluate which solutions are successful and desirable?

This publication gathers all abstracts that are accepted for presentation at the 22nd European Meetings on Cybernetics and Systems Research. They are abstracts of three keynote speeches, three theme speeches, five invited distinguished lectures, five invited demonstrations, 151 presentations, at 22 Symposia within the themes of Sustainability & Development, Emergence & Design, and Complexity and Strategy, and the PhD Colloquium that are designed by the community and/or the chairs.

Keynotes

- The need for both specialists and generalists. All the global problems call for a systemic approach, but most problems are local and can be handled in a sectoral fashion, by Mario Bunge (2014 Laureate of the Ludwig von Bertalanffy Award in Complexity Thinking)
- Organizing for Sustainability, by Markus Schwaninger (2014 IFSR W. Ross Ashby Memorial Lecture)
- A dynamical interpretation of emergence and its consequences, by John Collier

Theme speeches

- Systems knowledge and beyond – contributions of research to sustainable development, by Marianne Penker
- Associations for the Reciprocal and Mutual Sharing of Advantages and DisAdvantages, by Pierre Bricage
- Understanding complexity: towards a technology of knowledge, by Bernd-Olaf Küppers

Distinguished Lectures

- Sustainable Development – Technology – Culture. Remarks to their Relationships, by Gerhard Banse

- Methodology of Transdisciplinarity: Its Importance for Building Sustainable Futures, by Basarab Nicolescu
- How to develop an “open” future: is it possible to take advantage of coherence and incoherence?, by Andrée Piecq & Claude Lambert
- Urban Green Line a new Infrastructure for Rome between past and future, by Antonino Saggio
- Ethics for robots?, by Robert Trappl

Demonstrations

- In Search of a Praxeology of Applied Research – The radical learning Journey of SEgroup, by Louis Klein & Christian A. P. Weiland
- The WELTribe Project Prospects, Plans and Promise, by Alexander Laszlo & Valeria Delgado
- The Evolutionary Learning Laboratory (ELLab) - a better way to analyse and overcome complex problems, by Ockie Bosch, Nam Nguyen & Kailash Krishnamurthi
- IIASA - Systems Analysis for Informing Policy, chaired by Elena Rovenskaya:
    - Integrated assessments can reconcile stakeholder conflicts in managing renewable natural resources, by Dorothy J. Dankel, Mikko Heino & Ulf Dieckmann
    - Systemic risks and security management in land use systems: stochastic GLOBIOM model, by Tatiana Ermolieva, Yuri Ermoliev, Petr Havlik, Aline Mosnier, David Leclere & Michael Obersteiner
    - Catastrophe risk modeling to inform proactive public finance for disasters: Focus on Madagascar, by Stefan Hochrainer-Stigler
- Shifting the dominant peace and security paradigm of the Israel/Palestine conflict, by Ofer Zalzberg & Sami Aburoza

Symposia

Sustainability & Development Theme, chaired by André Martinuzzi

Applications

- Disasters: Prevention, preparation and response, chaired by Gerhard Chroust & Georg Aumayr
- Economic systems change: Contributions to an inclusive and sustainable society, chaired by Manfred Blachfellner & Silvia Zweifel

Bridge

- Impacts for sustainability: Epistemology and research activism, chaired by Dino Karabeg & Alexander Laszlo

Concepts

- Corporate social responsibility: Multilevel foundations towards a new holistic framework of CSR and a new concept of economic value, chaired by Gandolfo Dominici
- Social and environmental responsibility: Balancing individual and collective actions (IASCYS Symposium), chaired by Pierre, Matjaz Mulej & Francisco Parra-Luna

Emergence & Design Theme, chaired by Markus Peschl & Stefan Blachfellner

Applications

- Architectural ecologies: Code, culture and technology at the convergence, chaired by Liss C. Werner, Andrea Rossi & Lila PanahiKazemi
- Sustainability, ethics and the cyberspace, chaired by Stefan Strauß, Tomas Sigmund & Tomas Karger
- Urban systems research, chaired by Funda Atun, Ernst Gebetsroither & Christian Walloth
- Game-based learning in systems thinking, chaired by Fares Kayali, Peter Purgathofer & Peter Judmaier

Bridge

- Emergent Design, chaired by Thomas Fundneider & Martin Fössleitner

Concepts

- Bertalanffy and beyond: Improving systemics for a better future, chaired by Yagmur Denizhan & David Rousseau
- Ethics from systems: The philosophical perspective, chaired by Rainer E. Zimmermann & Robert Jahn
- Emergence in social systems theories and social science: Clarifications and applications, chaired by Poe Yu-ze Wan & Tomas Karger

Complexity & Strategy Theme, chaired by Gary Metcalf

Applications

- Systemic consulting, chaired by Louis Klein
- Systemic project management, chaired by Martina Huemann & Louis Klein
- Country development in a time of globalization, chaired by Paul Balonoff, Tatiana Medvedeva & Stuart Umpleby
- Risks in supply chain networks, chaired by Johannes Goellner, Gerald Quirchmayr, Manfred Gronalt & Thomas Wallner
- Social and technical “volatility”: Commonly shared reference problem of interdisciplinary research on the energy system?, chaired by Christian Büscher & Jens Schippl

Bridge

- Professional Systemics, chaired by Nikitas Assimakopoulos & Dimitrios Varsos

Concepts

- Unity through diversity: Learning in a complex world, chaired by José María Díaz Nafría & Rainer E. Zimmermann
- Transdisciplinary responses to global challenges, chaired by Søren Brier & Liqian Zhou
- Crossroads of civilization from a synergetic point of view, chaired by Iryna Dobronravova

PhD Colloquium & Award

- The organizing committee of the EMCSR 2014 encouraged researcher of pre-doctorate and early post-doctorate stage to present and discuss interdisciplinary research papers within a special Colloquium & Award competing for the Ludwig von Bertalanffy Young Scientist Award, a diploma and money prize, chaired by Alexander Laszlo, Pierre Bricage and Peter Fleissner.

As the meeting is a European one, the abstracts are written primarily by European authors (Albania, Austria, Belgium, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Ireland, Macedonia, Netherlands, Norway, Portugal, Russia, Slovenia, Spain, Sweden, Switzerland, Turkey, UK, and Ukraine). But we were honoured to welcome participants from all regions of the world, like Asia (China, Israel, Japan, Malaysia, Nepal, Taiwan), Africa (South Africa), Australia, New Zealand and Americas (Argentina, Brazil, Canada, Chile, Ecuador, Peru, USA). Some authors are long-standing attendees of the EMCSR, a considerable number, however, participate again for the first time, among them 30 outstanding students of the systems sciences.

This Book of Abstracts builds the basis for the proceedings to follow. All authors are invited to submit full papers by revising their presentations in the light of the discussion at the parallel as well as plenary meetings. Accepted full papers will be published after a rigorous peer review process in the 2012 established Open Access Journal “Systema” at www.systema-journal.org.

We hope that this publication is a valuable contribution to the self-reflection of the field of systemics, cybernetics, informatics, evolutionary thinking, complexity, network analysis and other related areas.

About the Editors

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Jennifer Wilby is a Senior lecturer and member of the Centre for Systems Studies in the Business School at the University of Hull, UK. Jennifer is a Fellow of the International Academy of Systems and Cybernetic Systems (IASCYS), President of the United Kingdom Systems Society (UKSS), Past President (2010/11) and Trustee of the ISSS, Vice President of Administration for ISSS, editor for several ISSS publications, and editorial board member for several International Systems journals. [email: j.wilby@hull.ac.uk]

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Stefan Blachfellner, M.A. works internationally as an entrepreneur in business and communication design from Europe to China with broad experience in industries and the service sector as well as in public administration and cultural and educational organizations.

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Keynotes

Mario Bunge: Big questions come in bundles, hence they should be tackled systematically
Department of Philosophy, McGill University, Montreal, Canada
2014 Laureate of the Ludwig von Bertalanffy Award in Complexity Thinking

John Collier: A dynamical interpretation of emergence and its consequences
Philosophy and Ethics, University of KwaZulu-Natal, Durban, South Africa

Markus Schwaninger: Organizing for sustainability
Institute of Management, University of St. Gallen, Switzerland
2014 IFSR W. Ross Ashby Memorial Lecture

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Big questions come in bundles, hence they should be tackled systematically

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Abstract: Problems come in all kinds and sizes. Small problems call for the use of known tools found in circumscribed fields, whereas big problems call for further research, which may require breaching disciplinary walls. This is because every small problem concerns some separable system whose components are so weakly linked with one another, that it may be reduced to an aggregate, at least to a first approximation.

I submit that (a) every problem concerns some system, and (b) analysis works only provided the system components are so loosely linked, that they can be treated as if they were isolated items. These methodological assumptions are key principles of systemism, the philosophy first expounded by d'Holbach in the 18th century, and rescued by Bertalanffy and his companions in the general systems movement in the last century.

Systems and systemism are so little known in the philosophical community, that the vast majority of philosophical dictionaries have ignored them. By contrast, all scientists and technologists have practiced systemism–except when they failed for having adopted either of the alternatives to systemism, namely atomism and holism.

A number of examples taken from contemporary science and technology are analyzed, from the entanglement typical of quantum physics to the design of social policies. Along the way we define the concept of a system, and note that (a) analysis is the dual of synthesis rather than its opposite; (b) systemism should not be mistaken for holism, because the former recommends combining the bottom-up with the top-down strategies; (c) systemism encourages the convergence or fusion of disciplines rather than reductionism. The recent replacement of GDP with more complex social indicators as the measure of social progress is regarded as a victory of the systemic view of society.

Finally, I argue that systemism is no less than a component of the philosophical matrix of scientific and technological research, along with epistemological realism, ontological materialism, scientism, and humanism. I also argue in favor of Anatol Rapoport's view, that systems theory is not a theory proper but a viewpoint or approach that helps pose problems and place them in their context.

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A dynamical interpretation of emergence and its consequences

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Abstract: Dynamical conditions for emergence are shown to underlie the traditional logical conditions of emergence of nonreducibility, unpredictability, holism and novelty. Emergent systems are the same as the set of complexly organized systems defined by Collier and Hooker. I describe the advantages of the dynamical perspective, and draw out some consequences for management of such systems.

Keywords: emergence, dynamical systems, novelty, cohesion, levels, hierarchy

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Emergence has been used in a number of ways, from mere mundane rearrangement among the relations among parts of a system through to a distinctly mysterious production from the material that is not itself material. In the philosophical tradition the notion was first used by G. H. Lewes in 1875 for something that is incommensurate with its components and not reducible to their sum or their difference (Blitz 1992). Philosophers J. S. Mill, and later C.D. Broad had similar ideas, which they applied to biological and mental systems, but to purely physical and chemical systems as well. The idea focuses on irreducibility together with "production from" component systems, and probably goes back in some form to Aristotle at least, and certainly to Kant. Irreducibility can be a result of our knowledge, our representations, or a condition of the target system itself. I will focus on the last because it implies the others, and I think it is the most interesting, but also because I think that a dynamical account of this sort of ontological emergence can both be tested and give us a better understanding of how emergent properties and systems form from underlying parts independently of our knowledge or how we choose to represent them, as well as what their properties and consequences are. The set of dynamically emergent systems is the same as the set of complexly organized systems defined by Collier and Hooker (1999).

1 Logical conditions for ontological emergence

C. D. Broad probably gave the best account of ontological emergence in logical terms, laying our necessary and sufficient conditions, as is typical for philosophers analyzing a concept. The conditions he laid out are 1) nonreducibility, 2) unpredictability, 3) holism and 4) novelty. Specifically, although emergent properties are produced by their component properties, they are not reducible to those properties, nor predictable from them. This applies to systems as well when their individuating properties are emergent. These properties imply holism and novelty. Broad did not consider emergence to be uncommon or mysterious, and thought that water might be emergent from its components. In giving a dynamical account of emergence, Broad's logical properties should be derivable.

2 Dynamical conditions for emergence

The most fundamental condition for dynamical emergence is that the constraints on the system are nonholonomic. Howard Pattee stimulated the author's interest in this condition. It is only a necessary condition, however. Holonomic constraints are ones that depend only on position, not time. All holonomic systems are predictable and reducible. A system can be predicted across time if and only if its trajectory can be calculated from its initial and boundary conditions specified within some region of its phase (state) space, together with its equations of motion, to be within some region of phase space at some arbitrary later time. Specifically, the trajectory of a system is predictable if and only if there is a region η constraining the initial conditions at t_0 such that the equations of motion ensure that the trajectory of the system passes within some region ε at some time t_1, where the region η is chosen to satisfy ε. Indeterministic systems have probabilistic predictability. Predictability applies in principle to all closed Hamiltonian systems (specifically, conservative of energy and holonomic; i.e., roughly, that the parameters of the system are a function of its energy and positions only), including those without exact analytical solutions, such as the three-body case. The systems without exact analytical solutions can be numerically calculated in principle for any finite time, if we have a large enough computer. We might call this stepwise computability. In general, for such systems, the predictions can be made to arbitrary accuracy by combining the interactions of pairs of components by successive approximations, and adding in increasingly accurate perturbations, ensuring reducibility. This can fail in nonholonomic systems.

Holonomic systems are just those that fit standard Hamiltonian treatments in which energy is conserved and potential energy depends on position alone. Near to Hamiltonian systems can be dealt with by approximations, and very far from Hamiltonian systems can be dealt with using step functions between states. The problem area for predictability and reducibility comes in the intermediate zone in which the rate of dissipation of energy in the systems is of the same order as the property of interest. In this case it is possible, but not necessary, that the boundary conditions of the system (its constraints) and the system laws may not be separable for the given system, either as a whole (especially if the property in question is its individuating property, without which it would not exist), or in just some regions of its phase space. The problem area occurs when the following conditions hold (Collier 2008, 2014):

1. The system is nonholonomic, implying the system is nonintegrable (this ensures at least incomplete reducibility)
2. The system is energetically (and/or informationally) open (boundary conditions are dynamic)
3. The system has multiple attractors (giving alternative divergent paths that arbitrarily close to each other)
4. The characteristic rate of at least one property of the system is of the same order as the rate of the non-holonomic constraint (radically nonHamiltonian)
5. If at least one of the properties is an essential (individuating) property of the system, the system is essentially non-reducible; it is thus an emergent system

I will show how the further logical conditions of emergence, novelty and holism, can be derived from these dynamical conditions.

These requirements are relatively easy to determine if we know the fundamental systems dynamics in mathematical form, but are more difficult to determine otherwise. I will make some suggestions about how we might determine emergence in more vaguely described systems, like we often encounter in biology and cognitive science, not to mention social systems as in politics and economics.

3. Some notable consequences of dynamical emergence

As I have mentioned, a whole system is emergent if its individuating property, what makes it what it is, is emergent. The reason is that without this property the system would not exist. All systems, though, are embedded in large systems with more general dynamics. We can ask, then, what the region is within the larger system emergent systems are likely to form. This involves questions of stability and possible bifurcation that are well known to chaos theorists. In general for systems that meet the criteria for dynamical emergence there will be regions of stability, transitional zones between stable zones, and regions of instability. Thus properties may be reducible within some regions and not in others. This is important for engineering purposes (whether physical, biological, mental or social engineering) for two main reasons. Sometimes we want to design systems with regions of stability in which performance is predictable and non-emergent within required operating parameters. Other times we want to design systems that will show emergent but stable properties. Knowing the likely behavior of the system throughout these regions and nearby in phase space will help with these goals. The other major engineering problem is dealing with given complexly organized systems with emergent properties in order to intervene as required for various management purposes, whether it is to control and prevent disasters, restore from disasters, or to encourage novelty and creativity. I will argue that it is necessary to work with the systems and not try to assert too much contra loin order to get good results. The most obvious ways to control are not often the best ones to get results in such systems.

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About the Author

John Collier is recently retired from the University of KwaZulu-Natal and maintains an association with the university. He is about to start the third year of three month stays in Brazil at the Institute of Biology at the Federal University of Bahia to work on function in ecology. The ideas here were started in the late1980s while Collier held a Canada Research Fellowship at the University of Calgary. The ideas have been developing and maturing since then.

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Organizing for sustainability

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Abstract: Ein theoretisch fundiertes organisationskybernetisches Konzept wird entwickelt, mit Hilfe dessen die ökologische Nachhaltigkeit unseres Planeten wesentlich besser gestärkt werden könnte als mit den üblichen Mitteln.

1 Organizing for Sustainability

The quest for the ecological sustainability of planet earth could be much more successful than is currently the case. The purpose of my presentation is to corroborate this claim and to propose a structure by which a sustainable future can be achieved. The issue of sustainability has been addressed in different contexts — local, regional and worldwide. I maintain that these efforts can only be effective, if actors at multiple structural levels cooperate simultaneously towards the vision of a sustainable world. The distribution of tasks along these organizational strata is a nontrivial task. To master it, a recursive structure based on the Viable System Model is presented, which shows how the efforts for sustainability can be organized in a much more powerful way than by conventional approaches. The proposed structure empowers agents at each level to generate variety in balance with the complexity they face. This presentation should also help decision-makers understand that pertinent frameworks are needed to enable actors at each level, from individual to global.

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Theme Speeches

Pierre Bricage: Associations for the Reciprocal and Mutual Sharing of Advantages and DisAdvantages ARMSADA: a fruitful predictive paradigm
University of Pau and Pays de l'Adour, Pau, France

Bernd-Olaf Kuppers: Understanding complexity: towards a technology of knowledge
Frege Centre for Structural Sciences, University of Jena, Germany

Marianne Penker: Systems knowledge and beyond: contributions of research to sustainable development
Institute for Sustainable Economic Development, Department of Economics and Social Sciences, BOKU University of Natural Resources and Life Sciences, Vienna

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Associations for the Reciprocal and Mutual Sharing of Advantages and DisAdvantages ARMSADA: a fruitful predictive paradigm

Pierre Bricage

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Keywords: apoptosis, breakage, cancer, cell level, curative vaccines, ecosystem level, governance, lichen, limits, metamorphosis, Monera, mutualism, network, organism level, parceners, prisoners' dilemma, symbiosis, threshold, trans-disciplinarity, virus, wholeness.

Key concepts: ago-antagonism [3], capacity of hosting, capacity to be hosted, constrain dangers, contingency, endosyncenosis, ergodicity, modularity, percolation.

Key paradigms: ARMSADA (http://armsada.eu), ecoexotope, endophysiotope.

To survive the living systems must to eat and not to be eaten. But, soon or late, every one is eaten [1]. The law of the strongest is not-at-all the best! The only way to escape for a moment from the struggle for life [2] is to enter into an Association for the Reciprocal and Mutual Sharing of Advantages and DisAdvantages (ARMSADA http://armsada.eu) [3]. A lichen is both an organism and an ecosystem. A cell is both an ecosystem and an endosyncenosis (ceno: to meet and fuse, syn: into a system, endo: with a new internal structural and functional organization). Both are ARMSADAs. A neuron emerges from the “unity through diversity“ between a population of Schwann's cells and a giant cell. The legumes' nodes emerge from the fusion of a population of Monera with an organism. The cell emerged with the help of a RNA virus from a microbial mat of Monera [3]. In their new endophysiotope (endo: internal, tope: space, physio: of functioning), the parceners are absolutely dependent from each others [4]. Every ARMSADA emerges when the partners lose simultaneously the capacity to kill the other one(s) [3, 5]. In the new Whole, all that is an advantage for a partner is a disadvantage for the other one(s). The “parceners“ are linked together “for the best and for the worst”. Symbiosis is not at all a win-win association but an ARMSADA [3, 4]: the benefits are not for the partners but only for their Whole which expresses new “abilities”. But, through the iteration of the process of new ARMSADAs' emerging, the new -more and more complex- “system-of-systems” is, more and more, independent of its ecoexotope (exo: external, tope: space, eco: of inhabitation). The endophysiotope [6] of a i level of organization is the ecoexotope of previous i-n levels. So the Whole is also less and more than the sum of its parts [2]: because of the semi-autonomy of the parceners abilities of the previous levels are lost but new are gained. There are never advantages without disadvantages! To survive that is to turn disadvantages into advantages and to avoid advantages turning into disadvantages: the survival of the fittest is the survival of the best fitted mutual sharing association! The systemic disfunction of its ARMSADA explains the cell apoptosis as the result of the death of one endangered internal partner (the moneral parts: the population of mitochondria or the nucleus), which results into the death of the whole endosyncenosis. Cancer also is a breaking of the cell's ARMSADA. Cells that should have to die, because of external dangers, “thanks” to the escape of internal dormant viruses do not [4]. Through this metamorphosis their new endophysiotope survives but their previous ecoexotope, the organism, is altered and endangered. Into an ARMSADA each partner can survive only if the other ones survive first. Man is not an exception! AIDS and cancer curative vaccines [4, 5] that had been proposed using this ARMSADA paradigm are coming effectively in practice. Ecosystems management must take into account that paradigm before any change, economic and social managements should too [7].

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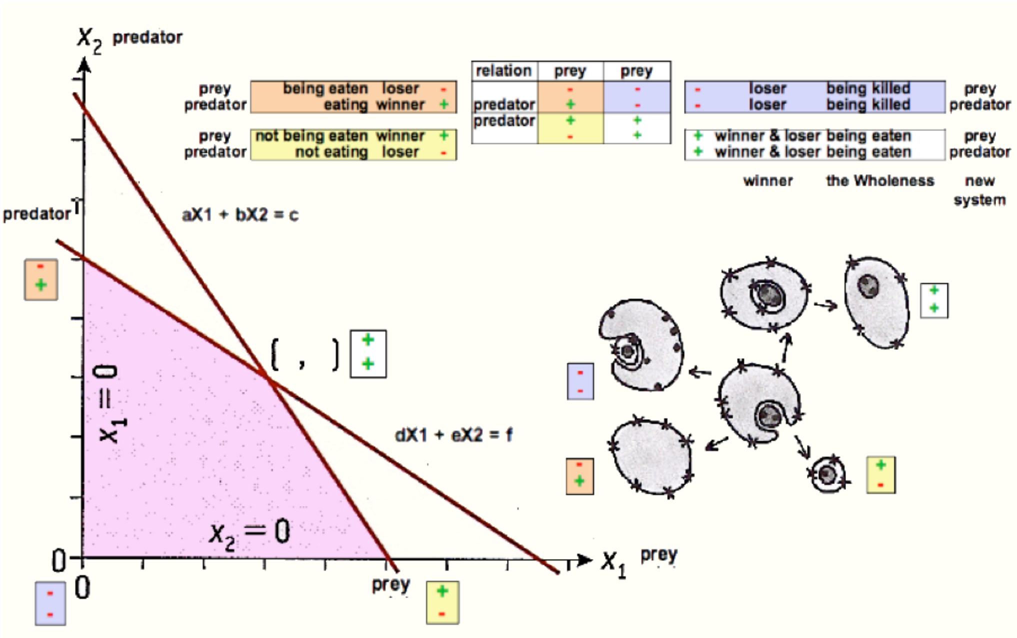

Figure 1: ARMSADA emergence. (Bricage Pierre, 2008, [4, 5], Creative Commons ShareAlike) Simplex representation of predator-prey interaction. Prisoners' dilemma like table. Emergence graph.

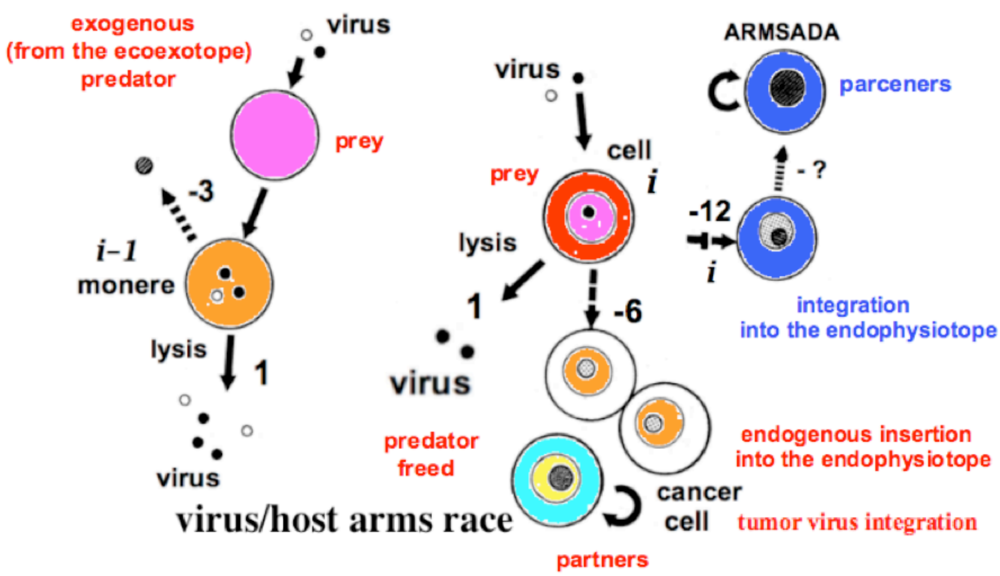

Figure 2: Constrained dangers integration. (Bricage Pierre, 2008, [5], Creative Commons ShareAlike) organization level: i, i-1, probabilities: -3, -6, -12 (power laws of 10), predator-prey interaction.

About the Author

Pierre Bricage

Born in 1947 (Paris, France, Europe), graduated in biochemistry, embryology and genetics from Paris 6 University (the first French University in ARWU, in the top 15 in Natural Sciences and 5 in Mathematics), as ENS Alumnus he passed the aggregation of biology. He learned American Civilization in CalTech, California (ranking 5). Now retired, he edited or published more than 250 pedagogic or scientific works in more than 20 countries http://web.univ-pau.fr/~bricage. During 8 years at the University of Dakar (Senegal, Africa), the biological rhythms of biochemical, ecological, physiological & genetical markers of plant enzymes & pigments were his research interests for sustainable management of natural resources and environmental education. As head of the Biology department at the University of Pau, France, he founded a centre for Agricultural Research. During 40 years, as researcher in biochemistry, enzymology, genetics, microbiology, animal or plant physiology, and systems analysis, he taught Systems Theories & Micro-Informatics applied to Quality Control, Health and Social Sciences (Societal Engineering and Man's Societal Environmental Responsibility). Pointing to Fundamentals in Biology, with On Line “Creative Commons” works (http://hal.archives-ouvertes.fr/hal-00130218/fr) he has been developing new Key concepts (endophysiotope, ecoexotope, gauge invariance of life, phylotagmotaphology http://hal.archives-ouvertes.fr/hal-00423730/fr), through the Paradigm of ARMSADA “Associations for the Reciprocal and Mutual Sharing of Advantages and DisAdvantages” http://www.armsada.eu, with applications in curative vaccines (cancer, AIDS). He is Vice-President of the French Association for Systemics and Cybernetics AFSCET (http://www.afscet.asso.fr), Deputy Secretary General of the European Union for Systemics UES-EUS (http://ues-eus.eu/), Member of the Directorate of the World Organisation of Systems and Cybernetics WOSC (http://www.wosc.co/) and Secretary General of the International Academy for Systems and Cybernetic Sciences IASCYS (http://www.iascys.org).

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Understanding complexity: towards a technology of knowledge

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Abstract: Understanding complexity: towards a technology of knowledge

Understanding complexity: towards a technology of knowledge

A mere mass of information in the form of unstructured data is not yet “knowledge”. At best, it contains potential knowledge, which can be made manifest by appropriate information-processing. For this, the set of relevant (i.e., meaningful) information must be selected and be set in relation with other meaningful information. This task, which may be described as „integrative data semantics (IDS)“, is an important part of “knowledge technology” or “knowledge engineering”. Knowledge technology in turn is based on a branch of science, which can be described as “structural” science. To this type of science belong systems theory, information theory, cybernetics, game theory, synergetics, complexity theory, network theory and others. The basic concepts of the structural sciences are all embracing abstractions of reality, with the help of which the characteristics of complex phenomena in Nature and society can equally be described. Knowledge technology avails itself of universal structures of knowledge, in order to position a particular science with its potential for application within a wider context and to exploit its potential for the solution of complex problems. To do this, it filters and bundles the relevant information that is scattered across a range of scientific disciplines, and weights it in a suitable way to address the problem on hand.

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Systems knowledge and beyond: contributions of research to sustainable development

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Keywords: Sustainable development, Mode 2 science, post-normal science, participatory science, transdisciplinarity, innovation systems

The EU Sustainable Development Strategy 2006, building on the 2001 Gothenburg Strategy and the 2002 World Summit on Sustainable Development in Johannesburg, identifies research for sustainable development as a critical challenge. Sustainability issues - such as climate change, the economic crises or poverty - often are complex and wicked problems, i.e. characterized by ambiguous problem definitions or unclear, conflicting and dynamically changing goals. Therefore, the task of designing long-term recommendations for governments, businesses and civil society is particularly challenging. Furthermore, these recommendations have to be formulated before all research that is needed can be completed and might affect many people and involve high costs, low reversibility and thus high decision stakes. In this context, research data on and clear insights into specific system dynamics alone are not sufficient to provide a clear path for future development.

Hence, high levels of complexity, uncertainty and high decision stakes call for new forms of knowledge production. “Mode 2 science” (Gibbons et al., 1994; Nowotny et al., 2001) and “post-normal science” (Funtowicz and Ravetz, 1993) focus on context-specific real-world problems without ignoring their international dimension and facilitate inter- and transdisciplinary collaboration between scientists and stakeholders outside academia. Thus, sustainability science should bridge the gap between science, decision-making and implementation. To meet this demand, sustainability researchers make use of three methodological and theoretical pillars linking to three types of knowledge (Pohl and Hirsch Hadorn, 2007):

- Theories and methods for integrated modelling, future scenarios, and assessments (for system and anticipatory knowledge on the genesis, development and interpretation of a societal problem);
- Theories and methods for the co-production of knowledge with stakeholders outside academia (for target knowledge on norms and values for a sustainable future);
- Theories and methods for governance and transition studies (for transformation knowledge on possible means of changing existing practices and introducing desired ones).

While system knowledge is essential, it does not suffice. If we want to take responsibility for the fate of our civilization and contribute to actual solutions for real-world problems, we also have to integrate target and transformation knowledge and to connect with experts outside academia. The latter promises:

- higher quality outcomes due to a broader and more context-specific knowledge base and
- social learning processes between scientists, decision makers and stakeholders resulting in a greater impact on society.

In the last two decades, we see a growing body of empirical studies reflecting on appropriate tools and methods to meet these promises. First evidence illustrate that the synthesis of heterogeneous, incomplete and uncertain academic knowledge with expertise from politics, administration, civil society or businesses helps to mitigate the “serious disconnect between scientific knowledge and the way that policy is formulated” (Glaser and Bates, 2011). Therefore, sustainability researchers start questioning the linear innovation model, where scientists produce objective knowledge that is communicated by consultants, media or the education system to citizens, policy makers or businesses who should embrace the scientific knowledge in a rather unquestioned manner. Adaptive, self-organizing societies would rather benefit from reflexive citizens caring for innovation systems that foster bi-lateral and direct interactions with scientists. The sustainable development movement can actually be an opportunity to open new pathways for knowledge production and innovation, which show a much deeper reflection and integration of societal needs and changes.

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Marianne Penker is deputy head of the Doctoral School Sustainable Development and the Institute for Sustainable Economic Development, where she heads the Working Group Regional Development. She is an experienced leader and collaborator in national and international research projects and has published on the governance of food systems and socio-ecological systems, on processes of rural transformation and the transdisciplinary co-production of knowledge with stakeholders outside academia.

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Distinguished Lectures

Gerhard Banse: Sustainable development: technology: culture. Remarks to their relationships
Institute for Technology Assessment and Systems Analysis (ITAS), Karlsruhe; and Leibniz-Sozietät der Wissenschaften zu Berlin e.V., Germany

Basarab Nicolescu: Methodology of transdisciplinarity: its importance for building sustainable futures
International Center for Transdisciplinary Research and Studies (CIRET), Paris; and Professor Extraordinary at the School of Public Leadership, Stellenbosch University, South Africa

Andrée Piecq, Claude Lambert: How to develop an “open” future: Is it possible to take advantage of coherence and incoherence?
General Secretary, UES-EUS; Honorary President, S&O; and founder and Scientific director of G.I.R.O.S, Belgium
President, S&O; G.I.R.O.S., Belgium; and Complexitude Workgroup, France

Antonino Saggio: Urban Green Line: a new infrastructure between past and future for the City of Rome
University of Rome, nITRo Saggio, Italy

Robert Trappl: Ethics for robots or Asimov revisited
Austrian Research Institute for Artificial Intelligence (OFAI); and Center for Brain Research, Medical University of Vienna, Austria

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Sustainable development – technology – culture: remarks to their relationships

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During the past decade research in the field of Sustainable Development (SD) has taken more and more attention to the interdependences between SD and technology at the one hand and between SD and culture (in terms of requirements, linkages, connectivity, behavioral and educational content) at the other hand. This offers the chances (i) to clear the importance of technology for SD, (ii) to differ “cultural sustainability” from related perspectives (i.e. a regional one!) and (iii) to look closer to these interdependencies of SD, technology and culture in a multidisciplinary “overall view”. But: “Technology” and “culture” are fuzzy and varied used terms. In the here discussed relationship technology means sociotechnical systems in contexts of designing/production and using, culture means “patterns of” and “practices of” (perception, behavior, communication, consumption, production…). So we must discuss a “triple”: SD – technology – culture.

The importance of culture for technology begins with the selection of fields of technological development, goes up to real specific technological solutions and their acceptance (which includes preferences and evaluation criteria as well as their hierarchy) and ends at patterns and practices of using (not only in an individual manner).

The relationship between SD and technology is related to the question of the contribution of a specific technological solution to more or less SD (especially for efficiency, sufficiency, and consistency). This leads to three problems: (i) the problem of knowledge for, (ii) the problem of evaluation of (this includes technology assessment!) and (iii) the problem of implementation of technological solution(s).

The discussion on culture and SD takes place on a high abstract level so far, it’s about the concept of culture on the one hand and to (culturally) blind spots in the current debate on sustainability on the other hand. The “culture” (“cultivation”) of SD is the “Sustainabilization” of the culture lacking sustainability by today. The main and important question that arises concretely is the question of the cultural connectivity of sustainable solutions (mostly technology based) nowadays.

Keywords: Sustainable Development, Technology, Culture, Technology Assessment

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Studied chemistry, biology, and pedagogic at High School of Pedagogic Potsdam, Germany, and philosophy at Humboldt University Berlin, Germany; 1969 diploma; 1974 dissertation and 1981 habilitation on philosophical problems of technology; 1974 – 1999 scientist and senior scientist at Institute of Philosophy of the Academy of Sciences of GDR, Department of Philosophy of Technology at Technical University Cottbus, Germany, European Academy Bad Neuenahr-Ahrweiler, Germany, and Institute for Philosophy at University Potsdam, Germany; from 1999 up to July 2011 senior scientist at Institute for Technology Assessment and Systems Analysis at Karlsruhe Institute of Technology, Germany (former Research Centre Karlsruhe). Guest professor at Faculty of Humanities at Matej Bel-University Banská Bystrica (Slovak Republic), professor of general technology at Technical University of Brandenburg Cottbus (Germany), professor e.h. at Silesian University Katowice (Poland); lecturer at Potsdam University, Silesian University Katowice and Technical University Rzeszów (Poland). Since 2012 president of Leibniz-Sozietät of Sciences and Humanities Berlin (Germany).

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Methodology of transdisciplinarity: its importance for building sustainable futures

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Keywords: Transdisciplinarity, Levels of Reality, Logic of the included middle, Quantum realism, Sustainable futures

The most important achievement of transdisciplinarity in present times is, of course, the formulation of the methodology of transdisciplinarity, accepted and applied by an important number of researchers in many countries of the world. After many years of research, we have arrived at the following three axioms of the methodology of transdisciplinarity:

i. **The ontological axiom**: *There are, in Nature and society and in our knowledge of Nature and society, different levels of Reality of the Object and, correspondingly, different levels of Reality of the Subject.*

ii. **The logical axiom**: *The passage from one level of Reality to another is insured by the logic of the included middle.*

iii. **The complexity axiom**: *The structure of the totality of levels of Reality is a complex structure: every level is what it is because all the levels exist at the same time.*

We will discuss how and why we formulated these axioms and, in particular, we will stress the transition from the classical realism to the quantum realism. The importance of this methodology for education and for building sustainable futures will be stressed.

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Honorary theoretical physicist at the Centre National de la Recherche Scientifique (CNRS), Paris, France. Professor at the Babes-Bolyai University, Cluj-Napoca, Romania. Professor Extraordinary at the School of Public Leadership, Stellenbosch University, South Africa. Member of the Romanian Academy. President-Founder of the International Center for Transdisciplinary Research and Studies (CIRET), a non-profit organization (165 members from 29 countries), which has a web site at: http://ciret-transdisciplinarity.org/. Founder and Director of the *Transdisciplinarity* Series, Rocher Editions, Monaco, of the *Romanians in Paris* Series, Oxus Editions, Paris and of the *Science and Religion* and *Science, Spirituality and Society* Series, Curtea Veche, Bucharest. Editor-in-Chief of "Transdisciplinary Journal of Engineering&Science", Texas, USA. Basarab Nicolescu is the major figure of transdisciplinarity in the world. His books include: *From Modernity to Cosmodernity - Science, Culture and Spirituality*, State University of New York (SUNY) Press, New York, 2014; *Manifesto of Transdisciplinarity*, State University of New York (SUNY) Press, New York, 2002; *Science, Meaning and Evolution - The Cosmology of Jacob Boehme,* Parabola Books, New York, 1991. He edited *Transdisciplinarity - Theory and Practice,* Hampton Press, Cresskill, New Jersey, 2008. A complete bio-bibliography of Basarab Nicolescu can be found on the page http://basarab-nicolescu.fr/

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How to develop an "open" future: Is it possible to take advantage of coherence and incoherence?

Andrée Piecq
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Today all organizations are in trouble. It looks like it was not enough to leave a linear view to access the systemic vision. As theorists and practitioners, working with organizations we daily make the next observation: it is necessary to construct another way of thinking. We wish to follow our predecessor's way and go further in the construction of models, without considering that it is possible to reach a final and complete model. We are convinced that each stage of evolution and each context must have a new understanding: one from a "higher" level.

A single answer would be inconsistencies in society. A single answer does not exist; it would opposed to our definition of the systemic approach. The answer can only appear in the emergence of multiple issues, each containing a large number of others. A single answer does not allow the emergence of new paradigms and run the risk of being the vision of a single organizational domain. The new systemic could emerge from all the differents domains together.

So we consider that the tomorrow systemic would be an "opened" systemic. This pooling could fear an emergence of inconsistencies. But which inconsistency does exist without consistency? And isn't inconsistency carryring creativity ? From this assumption we have the "vision"of a new systemic ,from which emerges "an" open future in which worlds' conflicts will be more meaningful (political, economic, scientific , philosophical and religious ...). The emergence of incoherence from this pooling creates fears, but the question is, does inconsistency exist without consistency? And would inconsistency enabled creativity?

This new systemic should have a larger view and some rules to conduct all the disciplines to attend this level. This level is not independent. It depends on the previous level and prepares the next top level. The lowest level must be considered as a micro level, the middle one as a meso level and the highest one as a macro level. Respectively, this macro level is contained by other level then becoming itself a micro level and so on. A single level does not allow the emergence of new paradigms and would run the risk of being only the vision of a single organizational domain. It is the shock, the confrontation of all organizational levels which could conduct to the emergence of a new systemic.

In this paper, we develop an approach to the control of the intervention in human organizations. We make our choice within constructivist epistemology with a focus on modelling rather than the application of models. We consider that the context, in which organizations operate, does not allow the use of predictive models. Current models are not efficient enough in the present time. The renunciation of application of existing models led logically to a modelling approach that is more comprehensive than explanatory? For this purpose, we have equipped ourselves with an approach that can enable the evolution of organizations, according to the circumstances and time context. This complex modelling approach fits into the circular relationship between the observers, the collection of multiple observations, leading to the progressive development of the structure of the organization by linking variables together. This heuristic approach leads to the formulation of assumptions. They allow us to diagnose the operability of the system in its context. This approach is part of a circular process in which the coherence of a system develops. The heart of our approach is built by the choice of the observer defining a set of mesoscopics variables that will be powered by the field data (micro) and guided by the modeller project (macro). These mesoscopics variables are developed and based on the fundamental principles of system sciences. The requirement of validity of these principles is stripped from ideological connotation. They are enough practices to facilitate the modelling work. Finally they must meet intersubjective agreement in systemic community. By analogy, the principles used, play the role of operators in a complex equation, that inform us about the functioning of the organization. As in mathematics, the function does not predict any values; the managing principle has no determination on the content that will be observed. In fact, the principle takes a weight in relation to other principles. In other words, the weight and value of the information are not determined by a model. From all interactions between the principles, emerge the structure of the organization. The emerging structure, also called meta-structure, highlights the self-organizational dimension of the system without claiming objectivity. This modelling does not pretend to give a completeness of representation and is based on the incompleteness considered as a resource. Modelling the emerging organization, allows us to maintain or change the properties of the system depending on the purpose.

Keywords: coherence, incoherence, emergence, modelling, constructivism

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Urban Green Line: A new infrastructure between past and future for the city Rome

Prof. Arch. Antonino Saggio, PhD

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The more the city develops outward (taking over permanently precious and vital soil!) more abandoned and used lands are left behind. To stop the use of precious soil outside the city we have to use abandoned area INSIDE the city but.. in order to move energy towards use of Abandoned areas in the city we have To create Infrastructures!

Infrastructures of new generation for the inner city are Based on Five principles.

The Urban Green Line is a thirteen kilometers long ecological and infrastructural ring which aims to connect the two metropolitan scale areas, Archeological Park of Caffarella and the Centocelle Park in Rome. The ring is composed by 21 traits of existing roads, to which is assigned a project that enhances the local and global impact. The presence of the Urban Green Line connects also a big number of urban voids. The mobility through a new tram line becomes the driving force of a wide overlapping of interventions, finalities and of a design proposal that results very interesting to the city.

The UGL™ holds its development bases on five guideline principles.

1. MultiFunctionality
2. Systematic Green
3. Information Technology foam
4. Living Accessibility, 5. Magic Crisis

About the Author

Prof. Arch Antonio Saggio, PhD

Antonino Saggio is an architect, scholar and professor and holds the Architecture and Informaton Technology Chair at the School of Architecture at Sapienza, University of Rome. He is the coordinator of the PhD program in Architecture Theory and Design which is one of the oldest and more relevant in Italy. The PhD program is offered by the Deparment of Architettura and Progetto of which Saggio belongs since 1986.

He is the founder and editor of the international book series "The Information Technology Revolution in Architecture". The book series is very popular among students and scholars around the world being published in English (by Birkhäuser), in Chinese (by Prominence) and in Italian (Testo&Immagine, Edilstampa). The 35 books being published so far represent an important theoretical and cultural survey of the new digital realm of architecture. He is a personal friend of the Institute of Ecothecnics and John Allen who are the creator of the Biosphere II project in Arizona, in 1993.

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Ethics for robots
or
Asimov revisited

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In 1950, Isaac Asimov presented his three laws for robots. While at that time ethical laws for robots sounded very futuristic, 60 years later robots are starting to enter the workplace as partners and the households as helpers. Currently, their sensory, cognitive, and action capacities are quite limited, but already now the increasing autonomy of e.g. military robots, especially drones, forces us to consider to which extent they should be allowed to make potentially fatal decisions. But also in the non-military area it is quite likely that in the near future robots that assist ageing persons or persons with special needs and that have long-term relationships with their human partners will have to make decisions based on ethical principles. Let alone autonomous vehicles that are already driving on our roads, still with a driver in her/his seat to intervene but probably not for much longer. In this presentation, Asimov's laws will be discussed first, then compared with several ethical principles that are currently considered. A prerequiste for implementing ethical principles is the autonomy of a system, therefore models of personalities for robots will be presented, followed by a few (experimental) examples of already implemented ethical systems. More detailed information about prerequistes, methods, and implementations of ethical systems in robots can be found in a forthcoming book "A Construction Manual for Robots' Ethical Systems", edited by this author.

Keywords: Asimov, robot, ethics, moral, autonomy, personality model, autonomous vehicle.

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Robert Trappl is Head of the Austrian Research Institute for Artificial Intelligence (OFAI) where he also leads the Group "Applied Cognitive Systems and Social Robotics". He is Professor Emeritus of Medical Cybernetics and Artificial Intelligence at the Center for Brain Research at the Vienna Medical University. His website: http://www.ofai.at/~robert.trappl/.

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Demonstrations

Ockie Bosch, Nam Nguyen, Kailash Krishnamurthi: The evolutionary learning laboratory (ELLAB) - a better way to analyse and overcome complex problems

Dorothy Dankel, Mikko Heino, Ulf Dieckmann: Integrated assessments can reconcile stakeholder conflicts in managing renewable natural resources

Tatiana Ermolieva, Yuri Ermoliev, Petr Havlik, Aline Mosnier, David Leclere: Systemic risks and security management in land use systems: stochastic GLOBIOM model

Stefan Hochrainer-Stigler: Catastrophe risk modeling to inform proactive public finance for disasters: focus on Madagascar

Louis Klein, Christian Weiland: In search of a praxeology of applied research: the radical learning journey of SEGroup

Alexander Laszlo, Valeria Delgado: The WELtribe project prospects, plans and promise

Ofer Zalzberg & Sami Aburoza: Shifting the paradigm of the Israel/Palestine conflict

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The Evolutionary Learning Laboratory (ELLab): a better way to analyse and overcome complex problems

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Abstract: Evolutionary Learning Laboratories provide a platform for all stakeholders in a given scenario. The idea is to collaborate and develop a shared understanding of the complexities in a given system. Participants are then encouraged to identify core issues, look at key leverage points and design systemically determined, effective and sustainable solutions. ELLabs use a tested seven step process to build capability in the area of Systems Thinking. The universal design of this process keeps it relevant to organisations, governments, companies and individuals. When applied in different environments the same model yields different results in each area of intervention. The successful application of ELLabs for dealing with complex issues, the growing need for its application and potential benefits in different global contexts led to the evolution of Think2Impact©. As a collaborative web-based global platform for applied Systems Thinking, Think2Impact© is aimed at scaling up the successful ELLabs model to create an ecosystem that can help individuals and organisations understand and manage complex challenges more effectively.

Keywords: Evolutionary Learning Laboratories, Think2Impact©, Applied Systems Thinking, managing complexity, systems tools, problem solving.

1 Dealing with Complexity

The range of what we think and do is limited by what we fail to notice, and because we fail to notice what we fail to notice, there is little we can do to change, until we notice how failing to notice shapes our thoughts and deeds. (Ronald Laing)

1.1 Disparate mental models

There is nothing new in the idea that individuals hold conflicting perceptions of the same phenomena. Each of us has a different set of visions, aspirations and views (mental models) of how to deal with the world around us, and this understanding has been used in cognitive science for over 70 years (Craik 1943) to help explain human behaviour. Our mental models contain information accumulated through our lived experiences and determine our perception of new information, and help us create new knowledge.

Unfortunately, we cannot simply look at other people and discern their mental models, any collaboration and consensus of people is a matter of shared experience, coincidence, or the result of honest discussion and understanding. When people grew up and lived in largely isolated communities, individual mental models among members of the community tended to coincide. In the 21st century, isolation is rare and diversity, complexity and ambiguity are the norm. We have all become interconnected in a vast physical and digital web. Potentially contentious issues, such as healthcare, environmental protection, gender relationships, poverty, mental health, economic development, migration, land use or water allocation (just to name a few), are now tangled and magnified in a global system of ecological, economic, social, cultural and political processes, ideas and dynamic interactions (Vorley 2002; Pimbert, Thompson et al. 2003; Thompson and Scoones 2009; Jackson 2010).

Different assumptions, knowledge and objectives among disparate stakeholders – mental models – make the management of our lives and work increasingly difficult because modern interpersonal, political, environmental, socio-economic, and business-financial issues now tend to transcend the jurisdictions and capacities of any single individual, organisation, profession or government department. Mining, for example, evokes sharply different reactions among individual politicians, miners, farmers, shareholders, the workforce, academics, healthcare workers and environmentalists, all of whom live with a different mental model of the meaning of the verb 'to mine'.

Current approaches to understanding and resolving such complex problems are almost universally ad hoc. Few individuals or groups consider the issues holistically, i.e., few appreciate the interconnectedness of the elements of the vast system of which they are a part; and honest discussion is rare. Silos of ideas, policy and activity abound. And issues bubble along without satisfactory resolution, ranging from ocean protection to city planning. It has become clear that more comprehensive and cross-partisan approaches are required (Walker, Porter et al. 2012), that they must take into account participants' mental models and encourage systems thinking.

1.2 The Role of Systems Thinking

The fundamental assumption underlying our work with Evolutionary Learning Labs is that we are surrounded by systems, and are, indeed, a part of systems. Humans are not, however, in the habit of seeing this or of thinking systemically. Even when we can see that 'something is wrong with the system', we tend to analyse the problem by breaking the system down to smaller and smaller parts looking for that which is faulty until we begin to lose sight of the interactions between all the elements (Ackoff 1987; Ackoff 1999; Dekker 2010). This type of thinking is a logical consequence of the sheer difficulty of observing and interpreting the actions and reactions of people or things synthetically (or holistically). That is, it is mentally easier to break a thing down to inspect individual components than to study the component and its relationship to other components simultaneously. Actions are often difficult to understand; interactions multiply that difficulty. Yet, it is only by appreciating the dynamic interplay of all the elements in a system that today's complex social, economic or environmental problems can be solved (Mingers and White 2010; Dodgson, Hughes et al. 2011; Keegan and Nguyen 2011; Nguyen, Bosch et al. 2011; Smith 2011).

This is, of course, not a new idea. As the conservationist John Muir pointed out before 1914: *When we try to pick out anything by itself we find it hitched to everything else in the Universe* (Gifford 2006). What is new is a shift in thinking that began with Ludwig von Bertalanffy in 1928 and has developed during the latter half of the 20th century into a new way by which to examine and to think about the world (Debora 2002). Systems thinking is now fundamental to business and management (e.g., Jackson 2003; Senge 2006), to leadership performance (Palaima and Skarzauskiene 2010), to biology, ecology, engineering, to the sciences in general (e.g., Midgley 2008; Godfrey 2010; Mingers and White 2010; Riess and Mischo 2010; Klocker Larsen 2011). And humans instinctively understand the importance of systems and their parts. What we don't instinctively do in society at large is regularly solving problems by considering the whole system, tending to focus instead on the part that appears to be malfunctioning (Sherwood 2002; Meadows 2008). Thus, governments attempt to control obesity by encouraging exercise or influencing food choices without also considering food culture, city planning, pet ownership, economic pressures, advertising, agriculture, human nature, serving portions, convenience, the availability of time for food preparation or other health issues that inhibit activity. Or try to save species by establishing national parks with porous boundaries and already full of feral animals, or solve developing world sustainability by simply providing untargeted aid funds.

1.3 Learning to Think in Systems through application of ELLabs

Systems thinking is not a natural act for most people (Valerdi and Rouse 2010). Human evolution has favoured mechanisms tuned to dealing with immediate surface features of problems (symptoms), and the complexity of systems also tends to overwhelm our cognitive capacities (Checkland 1999; Leveson 2011)

A major significance of the development and application of the ELLab approach is to greatly advance our understanding of how to achieve our economic, social, political and environmental aspirations without conflict and destruction in the context of a massively interconnected global system. There are a multitude of difficult, long-term global challenges ahead, almost all of which are coupled with our most pressing national and local concerns. Policy makers, managers and leaders today are expected to deliver innovative solutions to cope with increasing change and uncertainty across diverse hierarchical structures.

Furthermore, problems within one particular system or sector of society can no longer be viewed and solved with narrow single dimensional mindsets and tools. Therefore another significant feature of the ELLab approach is to enhance cross functional, cross-sectoral communication, engagement and collaboration to develop a common understanding and shared visions. The ELLab approach emphasises a new way of making decisions that involves open discussion, amending mental models, trialing new learning and consensus building among all stakeholders in a problem. Where once community leaders with a few advisors would make decisions and give direction on behalf of a community, the significance of our approach is that we are proposing a new way of thinking and acting, one which is holistic and inclusive and will lead to long lasting changes to mental models, to cultural changes in governments and organisations and lasting solutions to problems before they become chronic. And importantly, that lead to practical, targeted and consensus concluded sustainable outcomes.

If we are to grow as a society and address the complex challenges, which are increasingly characterised by uncertainty, ambiguity and competing stakeholder expectations, we need our leaders and key decision makers to be equipped with new and innovative tools and capacities and our institutional frameworks to be increasingly dynamic and transparent – the goal of ELLabs.

Learning to think and act systemically is of significant importance to help companies, organisations, individuals, achieve their goals and directly benefit the economic, environmental and social responsibilities of local and central governments, organisations, business institutions and society in general. This is what the systems-based ELLab has been developed for - an ongoing cyclic process for evolving innovations, continuous co-learning and refinement of the innovative systems tools embedded in the ELLab for dealing with complex issues. The application of ELLabs further enables organisations/government departments/companies/NGOs/etc to achieve innovative ways for:

- developing and improving mutual understanding of the diverse mental models of different stakeholders
- empowering all stakeholders involved to be engaged in a connected journey to achieve accelerated outcomes
- designing strategies and pathways to move away from traditional linear thinking that leads to quick fixes and treating the symptoms, to long lasting systemic solutions
- interacting efficiently to collaboratively identify leverage points and systemic interventions to develop systems based strategic and operational plans that will address the root causes of issues
- developing a deep understanding of the interconnectedness between recommendations in order to develop efficient and cost-effective strategic and operational plans
- acquiring a working knowledge of cutting edge systems tools to test the outcomes of strategies, including the identification of unintended consequences – before actual implementation

Considering the shortage of practicing systems thinkers and the application of their research, it is important that the ELLab approach will lead to the above mentioned new and innovative ways in which system thinking can be developed within people and organisations. Research shows that systems thinkers can be developed through experiential learning and coaching (Allen 2010; Glasson, Mhango et al. 2010; Mendenhall and Johnson 2010; Nguyen, Graham et al. 2012). By advancing our work within different industries in establishing ELLabs as a systems-based methodology, we provide community leaders and managers of organisations with an innovative and highly creative mechanism to deal with complex problems. The significance of this methodology lies in the fact that engaging diverse groups of stakeholders in a cyclical process of co-experiences of systems thinking has been proven through our research to be highly successful in changing mental models and behaviour, regardless of the background or level of education of the individual (Nguyen and Bosch 2013; Bosch, Nguyen et al. 2013).

2 ELLab approach and training

The ELLab is a process, as well as a setting, in which a diverse group of participants engage in a cyclical process of thinking, planning, action and reflection for collective learning towards a common good.

Its key elements are that the stakeholders in a problem tackle real tasks and issues, learn with and from one another about the issues, take responsibility and support one another in their decision making and actually implement the solutions and plans after much reflection. Drawing on this idea, the ELLabs consist of a unique seven step iterative process (see Figure) of thinking and acting in which the participants engage in well-defined activities, creating a systemic framework and environment where policy makers, managers, local facilitators, members of the community and researchers collaborate and learn together in an 'experiential laboratory' – to understand and address complex multidimensional and multi-stakeholder problems of common interest in a systemic way (Bosch, Nguyen et al. 2013). The ultimate goal is to achieve coherent actions directed towards sustainable outcomes.

Although the interactions among the stakeholders are taking place in a physical space, it is a signal feature of the labs that they are an idea and a way of behaving and can take place anywhere, from a government ministry to a thatched hut.

Cat Ba Island: Fishing villages encroaching into the nature conservation areas (illegal fishing/ misuse of natural resources – root causes are poverty and low levels of education)

The systems-based action learning behaviours of an ELLab are briefly described as follows:

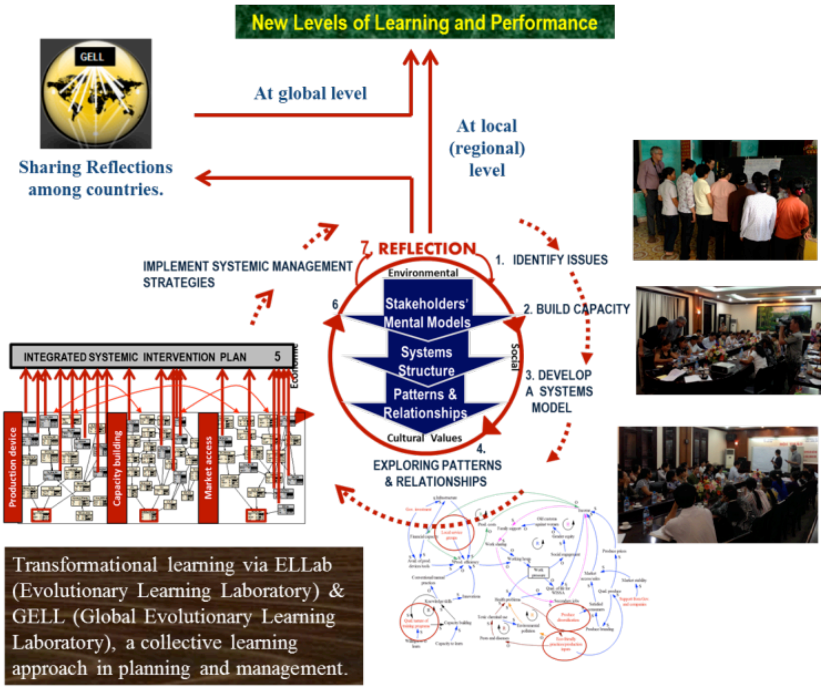


Figure 1 Framework of the systems-based Evolutionary Learning Laboratory (cyclic process)

Step 1 - Identifying issues: Issues workshops and a series of forums are held with specialist groups to gather the mental models of all stakeholders involved in the issue/problem under consideration. This helps stakeholders to achieve:

- an understanding of their own and other's mental models of the complex systems they are dealing with better collaboration and shared leadership
- an understanding of how emerging leaders lead and lead together
- engagement and the necessary interaction of various different areas of interest

- the identification of key issues that may require in depth studies (e.g. PhD studies)

(Workshops, focus group discussions, individual interviews)

Workshop to gather the mental models of women in agriculture, Ghana, Sub-Saharan Africa

Step 2 - Building capacity and Step 3 – Developing systems models: Follow-up sessions are facilitated for the establishment of the ELLabs, in which the participants (all stakeholders) are building capacity (informal training) in systems thinking, interconnectedness and model construction (using Causal Loop Diagrams and Bayesian Network Modelling) in order to achieve:

- various mental models being integrated into a systems structure
- 'ownership' of the systems model(s) through direct involvement and informal training
- an understanding of the inter-connectedness between and amongst different stakeholders (government departments and sectors in the organisation respectively) to improve communication
- the necessary links and needs for effective cross-sectoral collaboration

These include mainly

- Learning through systems games (such as Ecopolicy) and various modules for training. People who are intrinsically involved are doing all the modules, while some end-users (e.g. women in rural areas) are only involved in certain modules (e.g. for awareness), informally to help identify themes, discussing leverage points ranking the important variables, evaluate and validate the BBNs and ways to reflect on outcomes to maximise co-learning benefits).
- Integrating the mental models into systemic structures

For example:

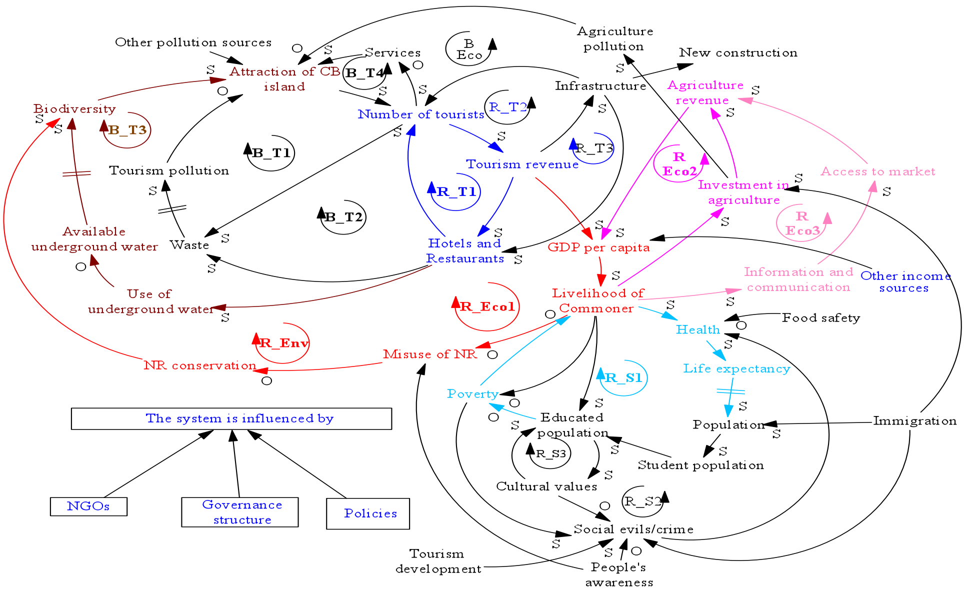


Figure 2 Systems model of CBBR – A Platform for Collaboration (Adapted from Nguyen, Bosch et al. 2011)

Legend: S (same direction), O (opposite direction), R (reinforcing), B (balancing), T (Tourism), Eco (Economic), Env (Environment), S (Social), 1,2,3 refer to loop number, e.g. R_T1 (Reinforcing loop no.1 of Tourism)

Constructing sustainable development models for Cat Ba Island

Women in agriculture discussing a systems model

Step 4 - Identifying leverage points and systemic interventions: Once completed, participants explore the model of each CS for patterns, relationships and what feedback loops, reinforcing loops and balancing loops exist to:

- develop an understanding of their interdependencies and the role and responsibility of each stakeholder group in the entire system
- identify the main barriers and drivers of the system to develop a deeper understanding of the implications of coordinated actions, strategies and policies
- identify leverage points and systemic interventions in the system in order to address the root causes of problems, rather than treating the symptoms

For example:

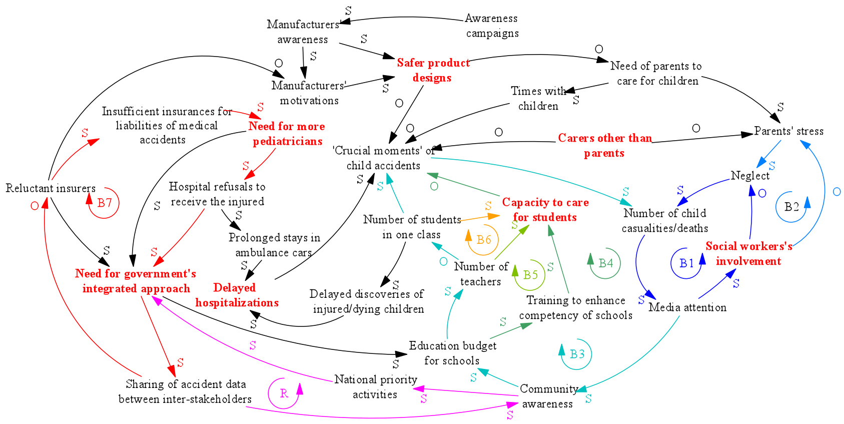


Figure 3 Causal Loop Diagram and Identified Systemic Interventions Points for Child Safety in Japan (in red)

Step 5 - Developing integrated strategic and operational plans: For each of the identified leverage points, Bayesian Belief Network (BBN) modelling (Cain, Batchelor et al. 1999; Smith, Felderhof et al. 2007) is used to determine the requirements for implementation of the systemic management strategies; the factors that could affect the expected outcomes; and the order in which actions should be taken to ensure cost-effectiveness and to maximize impact. This will lead to:

- integrated strategic and operational plans with systemically defined goals, strategies, activities, policies or technologies
- a stable governance arrangement that is suited to a particular context/place

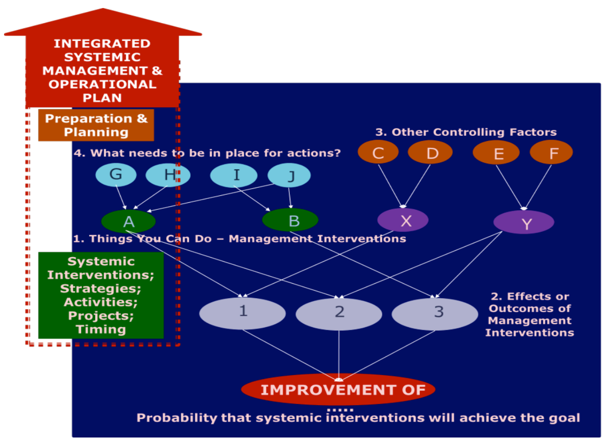
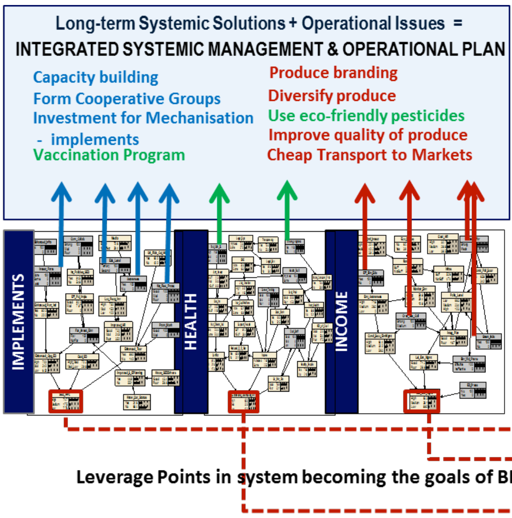


Figure 4 Basic framework for developing a BBN

- a basis for the development of design parameters for an appropriate governance system
- a means to test the possible outcomes of different systemic interventions by observing what will happen to the system as a whole when a particular strategy or combination of strategies is implemented, that is before any time or money is invested in actual implementation.
- In asking questions from 1 to 4, more experiential knowledge becomes unlocked. For example, the facilitator says "in other words if you have achieved outcomes 1, 2 and 3 the probability that there will be an improvement in …xx is about 100%". This statement could be met by a response "no, what about 4 and even 5 – these will also be important before there will be improvement in …xx. In this way more knowledge is obtained and built into the BBN model, until all participants are satisfied with the model. This process also leads to the participants "taking ownership" of the model.
- The systemic interventions (those actions that have the biggest effect on the end goal) are identified through testing how the different actions affect the end goal. For this, forecasting is used as well as back casting (making the end goal 100%).

Ghana woman farmer ranking factors for populating Bayesian belief Network models

These actions become the systemic interventions and with the planning (using the knowledge of participants on what needs to be in place and how to take into account the factors that cannot be controlled) the outcome is a systemic management and operational plan for achieving the particular goal. When the BBNs for each of the goals (leverage points identified during the Causal Loop Model interpretation) are combined it forms an Integrated Systemic management and Operational Plan for dealing with the complex issue under consideration (Figure 5).



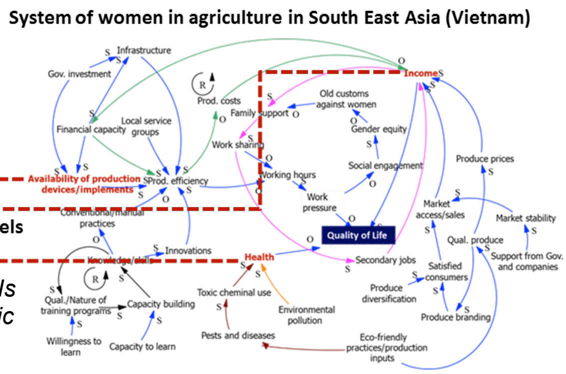


Figure 5 Systemic interventions of different BBNs are combined to form an Integrated Systemic Management Plan

Step 6 - Implementation of the strategies, policies and activities that will create the biggest impact is the next step for the people who are responsible for the different areas of management. Targets are being determined and monitoring programs are implemented to observe and measure the outcomes of the strategies and policies. This step provides opportunities to achieve:

- ‘experimentation’ with different systemically determined solutions
- leadership in practice, personally and with others using a systems-based action-learning framework

One of the leverage points that were identified in Haiphong for creating a new way of thinking for a new era leadership was to “Start with the Young”. The systemic intervention implemented was gamified learning to help people from a young age to develop an understanding of the concepts of systems and interconnected thinking.

A group of High schools and Universities in Haiphong was the first in Vietnam to take part in a series of competitions playing the cybernetics simulation game “*Ecopolicy*”. The competitions were run within schools and Universities in several rounds between small teams within classes and between classes, until a winning team for each school and university was determined.

The final competition (14 May 2013) was organised as an “*Ecopolicyade*” when all the winning teams from each school and University competed against each other in the presence of invited guests from all walks of life - managers and decision makers in Government, companies, businesses and organisations. The winning teams represented Haiphong at the 57th World Conference of the International Society for the Systems Science 2013 to compete in the International Ecopolicyade against the best teams from around the world. At this event, the teams were able to obtain advice from a world audience of systems scientists and representatives of international Governments, large companies and organisations – a truly inter-generational and inter-cultural co-learning experience for all involved on how to deal with the complex issues facing our world.

Winning teams at the Haiphong Final Ecopolicy Competition

Step 7 - Reflection: No systems model can ever be completely ‘correct’ in a complex and uncertain world and unintended consequences always occur. The only way to manage complexity is by reflecting at regular intervals on the outcomes of the actions and decisions to achieve:

- an evaluation of how successful or unsuccessful the systemic interventions are
- the ability to identify unintended consequences and new barriers that were previously unforeseen
- an iterative process serving as a valuable informal co-learning process that will lead to new levels of capability and performance (an ELLab)

3 Institutionalising the ELLabs

It is essential to ensure that the thinking and skills developed by participants through the systems elements of the program will be retained and utilised over the longer term by continuously identifying the barriers and drivers during the establishment of the ELLabs to develop systems models that can be used to:

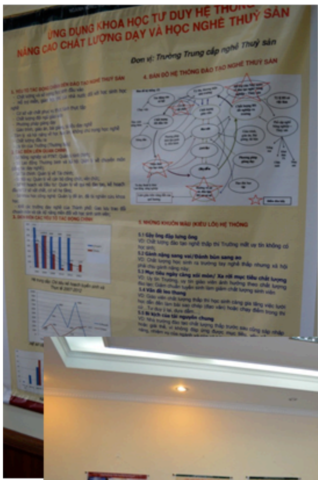
- determining the root causes of successes and failures in institutionalizing the cyclic process of developing shared understanding and collaborative goal setting
- refining the systems models with new knowledge and insights
- developing an ability to adapt systemic management strategies and policies
- implementing the interventions to help institutionalising the process and reflecting on their outcomes
- creating guidelines for sustaining the ELLabs as an ongoing process used by all stakeholders involved through the sharing of lessons learned from the outcomes.

4 Impact of ELLabs

The success of the ELLab approach has led to a Bill & Melinda Gates Award for establishing ELLabs for Labour Saving innovations for women in agriculture in South East Asia and Sub-Saharan Africa.

The successful establishment of the Cat Ba ELLab has led to various lessons learned that spilled over to the Haiphong Province government. For example, it became clear that a problem within a specific sector (e.g. tourism) cannot be solved by expertise only in that sector. The models contain components of various other sectors such as health, education, agriculture, etc., which are all interconnected. The Haiphong Government identified that their “silo” nature of governance is ineffective and made funding available to SDCM to establish the HP government as an Evolutionary Learning Lab for Integrated Systemic Governance.

Capacity building was regarded as the first step to enable all government officials to become active in the planned ELLab, Ecopolicy (systemic intervention to start with the young) has been introduced to all government departments and agencies in Haiphong as part of their in-job training. Teams were formed within each department to compete against each other. Each of the teams also have done a written examination about systems thinking and they had to develop their strategic plan (for each department) using what they have learned about interconnectedness and systems thinking. Of particular importance is how they used the experience they got from playing ecopolicy, as well as the capacity building we are doing in Vietnam to develop first a model of the systems they are dealing with in each department and then use these to identify leverage points and systemic interventions in order to develop an Integrated Systemic Strategic Plan for the department or sections of departments.



Systems training in Haiphong Government Departments (strategic plans against wall presented as posters)

The success of the Haiphong model for integrated systemic governance has led to invitations from Hanoi and Danang to help their Governments to establish similar ELLabs.

VUSTA (Vietnam Union of Science and Technology Associations) has established the Centre for Thinking Science (CTS). Professor Ockie Bosch and Dr Nam Nguyen are currently working with CTS to develop a national project on the enhancement of systems science in Vietnam.

The FPT Business School in Hanoi has invited Prof Bosch and Dr Nguyen to teach "Systems Thinking for Managing Complexity" in their MBA and other postgraduate programs from February 2014 onwards.

- Testimonials

  - For environmentally sustainable and responsible tourism development in the context of Cambodia – the systems thinking approach is a magnificently responsive and excellent tool. This approach can be applied in various fields and sectors scientifically, logically and practically." *H.E. Dr. Thong Khon, Minister of Tourism (Cambodia)*

  - A systems approach is an elegant way to address multiple dimensions of sustainable development planning and practice in biosphere reserves. The learning laboratory initiative in Cat Ba (Vietnam) isolated capacity for integrated planning as the major 'missing link' to meet the multiple use objectives of that biosphere reserve and have given better focus to planning follow-up projects" *Dr. Ishwaran Natajaran, Former Director of the Division of Ecological and Earth Sciences, General Secretary of the Man and the Biosphere Programme (UNESCO Paris)*

  - The learning laboratory for sustainability initiative and its systems thinking approach are of significant importance for the sustainable development of Cat Ba Biosphere Reserve, Hai Phong City, Vietnam" *Dr. Nguyen Van Thanh, Member of the Central Communist Party, Secretary of the Communist Party and Chairman of Peoples' Council of Haiphong (Vietnam)*

  - The learning laboratory being built in Nen River Basin, Northern East of China is of great importance to the sustainable utilization of water resources, environmental protection, as well as improving livelihood of people in this region". *Dr. Hong Wang, Deputy Director of Songliao Bureau of Water Resources Protection, Songliao Commission of Water Resources, Ministry of Water Resources (PR China)*

  - There are an increasing number of people around the world who know about the ELLab in Haiphong City as the City has been mentioned in the news in several countries recently:

    ~ In Australia: http://www.adelaide.edu.au/news/news64382.html

- ~ In the UK: Report for the Network Review, magazine of the Scientific and Medical Network, UK
- ~ In Slovenia: http://www.violeta.si/2013/07/systemic-approach-for-emerging.html

- The University of Patagonia has requested the involvement of SDCM in the establishment of an ELLab in the southern arid areas of Argentina. They are especially interested in the use of BBNs as management decision making tools and the learning of systems concepts through gamification (Ecopolicy). The University has made funding available for the translation of the game package into Spanish.
- The Bertalanffy Centre for Systems Sciences in Vienna has expressed their interest to become actively involved in the deployment and use of the ELLab approach.
- In the IFSR message of President, Dr Gary Metcalf: "… The work of Ockie Bosch and Nam Nguyen, profiled as part of the 57th ISSS World Conference in Vietnam, was recognized through a grant for a new project from the Bill and Melinda Gates Foundation. These are only two examples of encouraging developments and we hope to see many more continuing to evolve. We would like to profile many more examples on the new website, and to get more member organizations involved with these kinds of projects, and with each other." (Chroust 2013, p.4). *Dr Gary Metcalf, President of the International Federation for Systems Research (IFSR)*
- SDCM website
  - ~ http://blogs.adelaide.edu.au/business/category/research-2/systems-design-and-complexity-management/
- ISSS Video
  - ~ http://isss2013.gov.vn/en-us/home.aspx
- Media reports and links providing useful and additional information demonstrating impact:
  - ~ http://ecopolicy.isss2013.gov.vn/en-us/home.aspx
  - ~ http://www.youtube.com/watch?v=KR7mPPQswjg
  - ~ http://blogs.adelaide.edu.au/business/2013/05/17/starting-with-the-young-initiative-vietnam/
  - ~ http://baohaiphong.com.vn/channel/4920/201208/15-truong-hoc-tai-Hai-Phong-tham-gia-chuong-trinh-Tro-choi-phat-trien-ben-vung-2187381/
  - ~ http://haiphong.gov.vn/Portal/Detail.aspx?Organization=UBNDTP&MenuID=8317&ContentID=42640
  - ~ http://www.thp.org.vn/artice/2167/ban-tin-thoi-su-toi-ngay-07062013.html
  - ~ http://haiphong.gov.vn/Portal/Detail.aspx?Organization=UBNDTP&MenuID=8317&ContentID=43410
  - ~ http://www.youtube.com/watch?v=Oj7TlZYKQj8
  - ~ The first International Ecopolicyade event was on TV news the same evening (the whole news is about 25 minutes, please forward to see Ecopolicyade news from 10.10-13.30 minutes): http://www.thp.org.vn/artice/2545/ban-tin-thoi-su-toi-ngay-16072013.html
  - ~ http://blogs.adelaide.edu.au/business/2013/01/24/systems-design-complexity-management/
  - ~ http://business.adelaide.edu.au/documents/Starting-with-the-Young-Brochure.pdf
  - ~ News on Haiphong ISSS57 website: http://ecopolicy.isss2013.gov.vn/tabid/387/The-competition-of-Ecopolicy-game-for-the-first-time..aspx

    Note: some of the links are in Vietnamese, but if you click on the top line on "TRANSLATE" (not "English") the news articles are translated into English. Although the English is not very good, the main messages are clearly understandable.
- The Department of Education and Training is currently considering the introduction of Ecopolicy in all high schools in Haiphong as a compulsory activity.

5 Refinement and improvement of the ELLab approach

The successful application of this systems tool in many countries has led to its refinement and development of a web-based system tool Think2Impact© (www.Think2Impact©.org).

The refinement is done by addressing the limitations of the current ELLab, namely *scalability* (manual and people centric approach with strong reliance on specialists to a collaborative platform supporting a blended model of learning and problem solving that can be scaled up at a global level); *outreach/ participation* (limited ability to engage participants from various demographics to an online collaboration platform integrated with social media and big data analytics to facilitate greater collaboration, outreach and participation); *utilization* (limited access to specialists and workshop facilitators to a blended model that provides opportunities to utilize a range of tools, forums, data and resources globally and run multiple projects in parallel); *capacity building* (manual training and skills development to a blended learning model with access to a range of online, self-paced and gamified learning options to increase skill development and capacity building); *knowledge sharing* (sharing limited within project teams and specific geographies to a global content and knowledge sharing portal to exchange ideas, learnings and project information across a range of socio-economic domains); and *accountability and tracking* (limited ability to track value, monitor accountability and optimise outcomes of projects, to a value and impact tracking platform to record, track and monitor activities, assign ownership and responsibilities and review/optimise the value/impact of projects). Special attention is also given to *innovation* to foster entrepreneurship through the establishment of a global systems thinking ecosystem. The Think2Impact© ELLab that is currently being refined. The first prototype will be demonstrated during the 2014 EMCSR in Vienna and the 2014 IFSR Conversation at Linz, Austria.

The refinements and the architectural structure of Think2Impact© are illustrated in Figures 6 and 7.

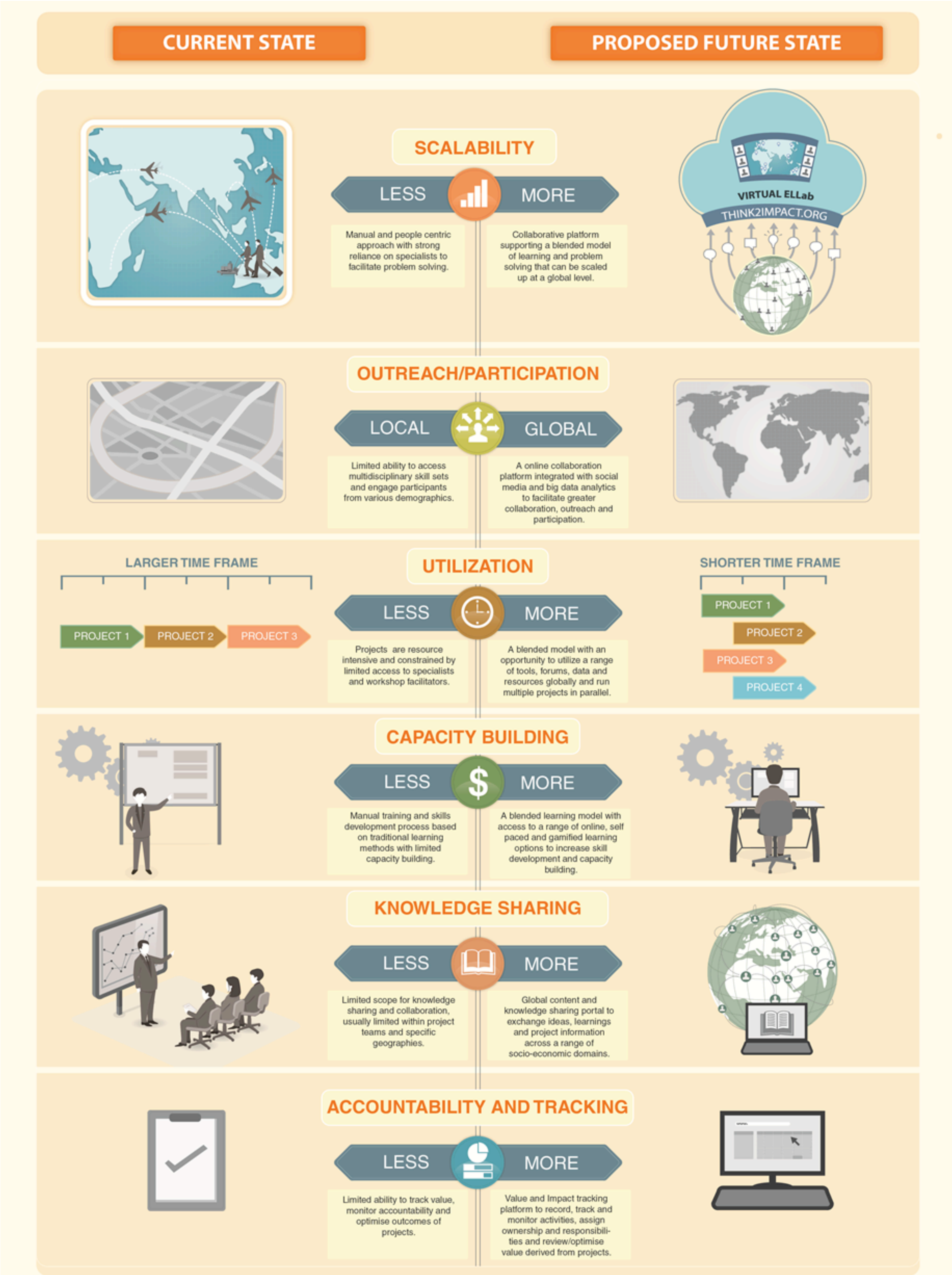


Figure 6 The current limitations of the ELLab approach and how these issues are being addressed is indicated in the following figure (current on the right and future on the left hand side of the middle line)

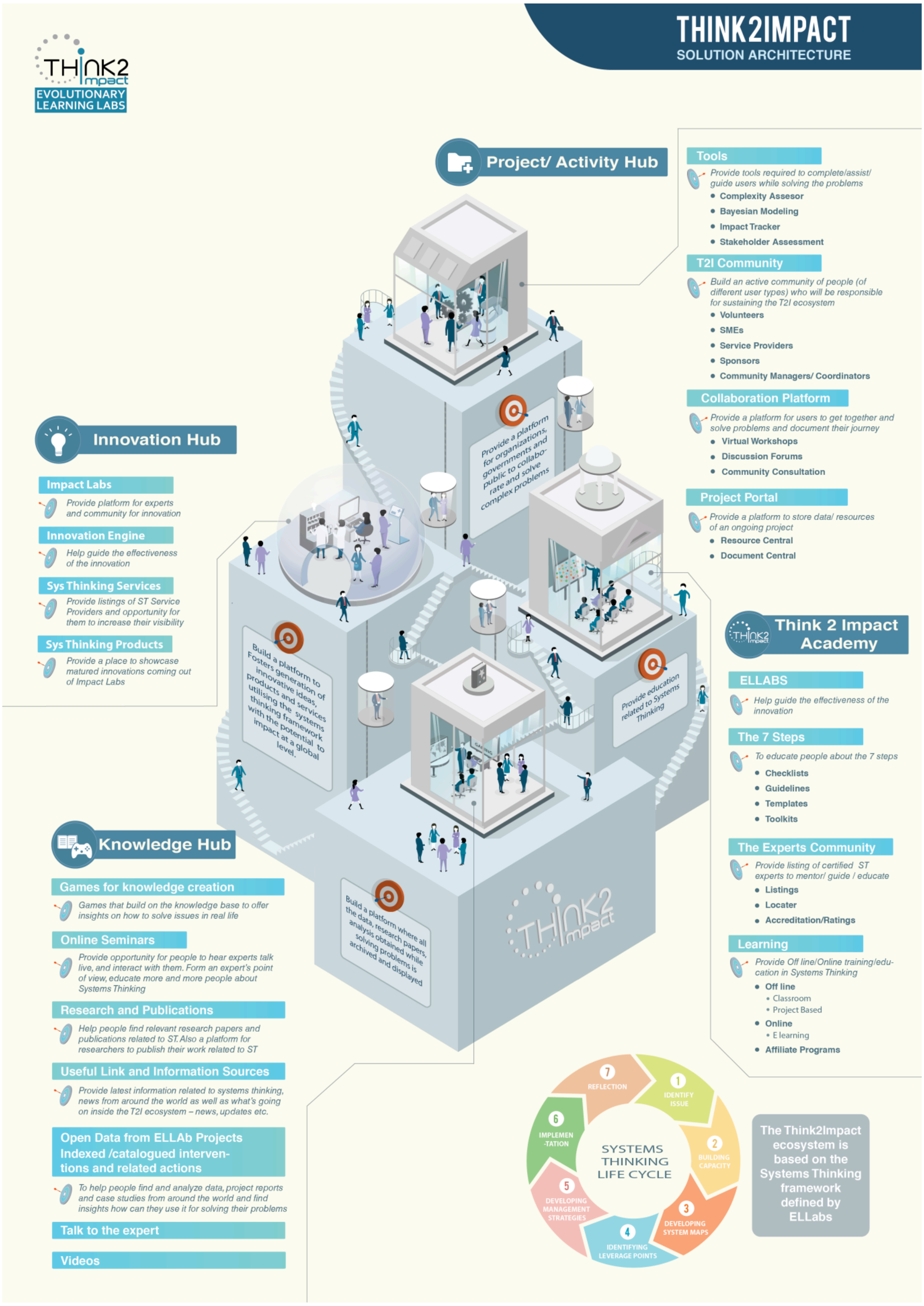


Figure 7 Solution architecture of Think2Impact©

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Even though he is still relative young in his research career, Dr Nguyen has contributed to the knowledge base of his research field by publishing 32 refereed publications and having 17 more refereed journal articles under review/in preparation. He is also a principal supervisor of 2 PhD candidates and co-supervisor of 1 PhD candidate in the Business School. Dr Nguyen is currently serving on the international editorial boards of the Bertalanffy Center for Systems Science journal: *Systema. Connecting Matter, Life, Culture and Technology* and the *American Journal of Management Studies*.

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Integrated assessments can reconcile stakeholder conflicts in managing renewable natural resources

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Sustainable use of renewable natural resources is a goal shared by scientists, policy makers, and stakeholders. Yet, inherent conflicts between objectives (e.g., yield maximization vs. conservation interests) regularly create impediment to attaining this goal. Could the recognition that seemingly conflicting objectives (e.g., economic profit vs. ecosystem preservation) are more compatible than commonly believed promote stakeholder consensus? Here we outline a quantitative approach to reconciling stakeholder conflicts through integrated assessments in marine fisheries. We link a biological model with a socio-economic model, both calibrated for the capelin and cod fisheries in Norway, define utility functions for five stakeholder groups, and evaluate different management options in terms of the resulting stakeholder utilities. Our results show that, for both cod and capelin, suitably low harvest rates and minimum-size regulations that protect smaller fish result in unexpectedly high joint stakeholder satisfaction, with the least satisfied among five modeled stakeholder groups reaching 90–93% of their maximally achievable utility. We demonstrate that stakeholder satisfaction for cod is more robust to uncertainties associated with stakeholder preferences and fish-stock fluctuations than stakeholder satisfaction for capelin. Our approach facilitates stakeholder inclusion in fishery management and helps deriving

management regimes that reconcile stakeholder conflicts by showing that conflicts between competing objectives are often weaker than they first seem.

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Systemic risks and security management in land use systems: stochastic GLOBIOM model

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Abstract: Interdependencies between land use systems resemble a complex dynamic network involving demand-supply relations. Some peripheral or insignificant at first glance event may induce ***systemic risks*** propagating through all systems with catastrophic consequences threatening food, energy, water, and environment (FEWE) security. Such scenarios are more probable when each system is governed by independent policies and the extent of influence each policy has on other systems is inherently uncertain. Integrated management of systemic risks and the FEWE security requires proper systems analysis (SA) methodology.

Keywords: Global (including climate) changes, interdependent land use systems, food-water-energy-environment security, systemic risks and uncertainties, GLOBIOM model, long-term planning, strategic and adaptive decisions, two-stage stochastic optimization, robust solutions.

This extended abstract is available from http://emcsr.net/book-of-abstracts/

In this talk, we discuss developed at IIASA stochastic optimization (STO) dynamic general equilibrium Global Biosphere Management Model (GLOBIOM) for integrated analysis of systemic risks and FEWE security in the context of increasing population demands, technological progress, environmental goals, resource constraints, and emerging systemic risks. STO GLOBIOM analyzes interdependencies among main land use sectors, such as agricultural, bioenergy and forestry, with the aim to provide policy recommendations on global, regional and local issues concerning land-related systems.

STO GLOBIOM's portfolio of decisions comprises not only strategic decisions on production allocation and construction of storages but also market regulations enabling design of robust integrated policies, including markets', to maintain security under systemic risks. By using selected numerical results, we demonstrate that properly designed storages and instantaneous adaptive markets' adjustments provide important means to hedge systemic risks, stabilize production and trade, and fulfill FEWE security requirements.

To increase understanding of the dynamic interactions between global trends and local resource use, stochastic GLOBIOM model embeds a robust probabilistic downscaling procedure permitting disaggregation of the results to finer resolutions (1x1 km grid) consistently with available fine-resolutions information, local-scale biophysical potentials and processes (including water, biomass, land resources availability of natural resources).

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Aline Mosnier is a Research Scholar with IIASA's Ecosystems Services and Management (ESM) Program. Since 2008, she has contributed to the development of GLOBIOM - a global land use model – especially on international trade aspects and biofuels. In 2010, she was responsible for the adaptation of the GLOBIOM model to the Congo Basin context to provide estimates of future deforestation and support national REDD strategies in the region. Ms. Mosnier holds a master's degree in development economics from CERDI-Universite d'Auvergne and is a PhD candidate in agricultural economics at the Life Sciences University of Vienna and at AgroParisTech. Before joining IIASA, she worked on rural development projects in Africa, agricultural trade policies, and aid efficiency.

David Leclere joined the Ecosystems Services and Management (ESM) Program in 2012 as a postdoctoral research scholar. His current research interests include the joint use of biophysical and optimization models to analyze the links between agricultural land, its management, and its physical environment. By means of enhancing and linking large-scale assessment models, his research focus will be put on developing integrated assessments of the interaction between agricultural activities, the climate and national to supranational policies. Dr. Leclere obtained his MSc degree in physics from Paris 11 & Paris 13 Universities and his PhD in environmental sciences from the AgroParisTech in France, in collaboration with the French Climate and Environmental Sciences Laboratory (IPSL/LSCE, UMR CEA/CNRS/UVSQ) and the French Public Economics Laboratory at INRA (UMR EcoPub INRA/AgroParisTech). Within his PhD thesis, he considered the impact of climate change over European agricultural supply by means of integrated simulation tools. He specifically focused on the effect of accounting for the heterogeneity of the physical environment of agricultural producers on larger scale outcomes such as EU-aggregated agricultural supply, GHG emissions and water withdrawal, through processes typical of the farm scale.

Michael Obersteiner is leader of the Ecosystems Services and Management Program at the International Institute for Applied Systems Analysis in Laxenburg, Austria. He joined IIASA's Forestry Program (FOR) in 1993 and has been leading the Group on Global Land-Use Modelling and Environmental Economics since 2001. His background includes the fields of global terrestrial ecosystems and economics, having completed graduate studies both in Austria (BOKU University and Institute for Advanced Studies Vienna) and abroad (Columbia University, New York and Siberian Branch of the Russian Academy of Sciences, Novosibirsk). Dr. Obersteiner's research experience stretches from plant physiology and biophysical modeling in the areas of ecosystems, forestry and agriculture to environmental economics, bioenergy engineering and climate change sciences as documented in his publications record.

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Catastrophe risk modeling to inform proactive public finance for disasters: focus on Madagascar

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Abstract: The CatSim (Catastrophe Simulation) model presented in this talk fills the information gap regarding the capacity and resources of a government to deal with natural disaster events. It evaluates the government's financial disaster risk management strategies by illustrating the tradeoffs and choices it must make to manage the catastrophic risks. The model assesses a government's contingent disaster obligations and the potential financial shortfalls and the costs and benefits of vulnerability-reducing options including financial management strategies. It is equipped with a graphical user interface to facilitate decision support in an interactive and iterative mode— a feature that is now seen as an essential part of risk management. The user interfaces as well as the underlying model framework was tested, changed and improved on various levels based on more than 20 high-level stakeholder workshops held in countries such as Turkey, Philippines, India, Nepal, Mexico, the Caribbean countries, and most recently in Madagascar in 2012. The focus will be on the latest model version as applied to Madagascar, which has one of the highest cyclone risks worldwide and has been confronted with a series of economic challenges in the recent past. It will be explained how the model was used within a real world setting, what problems were encountered in stakeholder sessions, and what solutions it has provided. In doing so, we will give recommendations as to how some of the more difficult concepts used within the disaster risk management field, e.g. probability and path dependency, can be most easily understood by non-technical trained stakeholders. Such understanding is beneficial in facilitating consensus building among various risk bearers from different sectors about the underlying nature of the current risk and ways to reduce them.

Keywords: Natural disaster risk, risk management, government, fiscal resilience, Madagascar.

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In search of a praxeology of applied research: the radical learning journey of SEgroup

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Abstract: When your work becomes the object of your research project, a learning journey starts. Systematic reflection of the paradigmatic conditions and contexts of this situation will allow for continuous feedback and additional learning throughout the research.

When you are an organisation concerned with change and organisational development, another layer comes into play: the content of your work becomes basis of basis of your research and both become basis for your own development: promoting change in organisations makes it difficult to shy away from your own development.

The case study of the Systemic Excellence Group will illustrate such a radical learning journey, its frames, milestones and flow leading to understand the systemic contexts of co-creating praxeological research. In the end some learning can be derived for applied research in general, not only for change research.

Keywords: Praxeology, paradigmatic reference, auto-ethnography, research processes, mental models, systems theory, narrative, critical theory, co-creation, context

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1 The SEgroup Story 2001-2013

On 12th September 2001 the Systemic Excellence Group started with a bold claim: Another change is possible! Building on the experiences in systemic organisational development, a few dedicated systems practitioners and researchers came together in Berlin. Inspired by this vibrant creative city, they wanted to step out of the frames of traditional research and mainstream consultancy. The legendary new economy had paved the path towards new thinking and alternative practices in business. In the creative atmosphere of those days, the SEgroup started a learning journey rather fuelled by passion than by the goal orientation. It was rather an expedition into the unknown. Innovation was not so much the focus. It came as a by-product. The idea was much more to improve systemic organisational development (OD) practices and to live up to the full potential of systems thinking for organisational practices.

The years since then turned out to be an intensive learning journey which took SEgroup from a starting as a systemic OD service provider towards becoming an independent think and do thank, supporting and reflecting change processes and change projects, not only in organisations. SEgroup created a unity of research in practice, where practice feeds into research and research feeds into practice. Seen from the outside, SEgroup appears as a Janus-faced entity where one face looks like a fully-fledged management consultancy focusing on change projects and the other face looks like a fully-grown academic research institute with a superb access to the field of change. Seen from the management consulting side, the research looks like quality assurance, which builds on academic rigour. And seen from the research side, the consulting looks like on-going fieldwork and action research which provides exciting opportunities to do the research at moments when the future is still open and rationalising cases from a known end can be avoided.

Today, SEgroup’s vision is clear: Changing the change! Oscillating between praxis and reflection, between consulting and research, propels the process, which systematically explores the conditions for the possibility of change and ventures new thinking and alternative practices. Innovation is one result. But what is more important is the efficacy in supporting value-creating change.

The SEgroup learning journey had been a radical one. Promoting change in organisations makes it difficult to shy away from your own development. On the contrary, if this is your passion, you are inclined to try it out yourself first. And this path of continuous change and innovation has not always been a straight one. Like a market curve, the development has been fluctuating, but the trend has been steady: What started as a small Limited in Berlin is now a global cooperative with Consortial Partners from San Francisco to Sydney and from Shanghai to Cape Town. And what for the moment looks like a satisfactory end will turn out to have been just another milestone on an on-going learning journey.

The following paper will present this momentary snapshot of this journey, what frames of references have developed over the years (2), how these frames have led to milestones in the journey towards a praxeology of applied research (3) and how process thinking has developed from a milestone to a more permanent flow (4). Being part of a global stakeholder community, it will be presented how milestones have been co-created (5) and an example for applied research will be presented (6). As in SEgroup projects, this reflection will also undergo a second-order reflection in form of lessons learnt: what is there to learn from this journey not only for the next steps for SEgroup, but for a global body of knowledge in the areas of change and project management (7). It is changing the change – one step at a time.

2. Frames of the Journey

Looking at any kind of substantial research, we expect a full account of the scientific frame of research, the methodological frame of research, and a proper description of the field in which the research is taking place. Looking into the research of change projects we expect the same. In reference to the learning journey described in the last chapter, there has been movement is these frames of reference and a process of development towards an adequate completion for the research endeavor. Looking for a praxeology of applied research, these frames go from an academic meta-level to more practical ones: From scientific over methodological frames to the disciplines of our work.

2.1 Scientific frames of reference

2.1.1 The Systemic Foundations

Starting with scientific frames of reference, it had been all cybernetics and systems theory in the beginning. Niklas Luhmann's theory of social systems (1984) can be marked as a founding stone of SEgroup research. This opens up a sociological perspective onto the dynamics of organisations. And links into an epistemological tradition of constructivism, especially Watzlawick (Watzlawick, Bavelas, Jackson, & O'Hanlon, 1967) and Heinz von Foerster (1979). Management cybernetics in the tradition of Stafford Beer (1995) created a good counterbalance and served as a bridge into management sciences. Chaos theory (Gleick, 1998) and debating complexity, however, called for a critical systems perspective as it was brought forward by Jackson (1991) and Flood (1990). And although over the years new frames were added to the focus on cybernetics and systems theory they served reliably as a scientific centre for the SEgroup research in change.

2.1.2 Enriching Scientific Frames

Exploring the conditions for the possibility of social systems to emerge and support their viability over time an additional set of scientific frames came into the play. We are looking at discourse theory, critical theory, epistemology and anthropology and ethnography.

Discourse theory relating to the works of Foucault, Bourdieu and Derrida (cp. Wetherell, Yates, Taylor, & Open University, 2001) allows for a thorough analysis of the world-view and the paradigmatic embedment as a specific context of a specific social system (cp. Klein & Weiland, Forthcoming). This goes hand in hand with Berger and Luckmann's insights in the social construction of reality (1967). In a certain sense this links back to constructivism, yet discourse theory puts that into a broader context.

Critical theory is often used synonymous with the Frankfurt School and its five leading protagonists: Macuse, Adorno, Horkheimer, Benjamin and Fromm (cp. Schirmacher, 2000). It is however not the general critical perspective on society as brought forward in the Frankfurt School which make critical theory so valuable. Especially seen from a systems perspective, critical theory provides the ground to counterbalance the conservative tendency of the processes of emergence. Emergent systems are conservative by nature and due to operational closure, it is difficult to generate a critical perspective from the inside. A counterbalance of this view can be provided by the perspective of the critical theory. The second generation of the Frankfurt School, especially Jürgen Habermas (1983) and even more so the recently brought forward theory of conventions (cp. Diaz-Bone, 2008), allow based on critical theory, for a calculus of values. Especially in times when value-driven management is highly rated yet poorly operationalised, critical theory puts the debate back on its feet.

Epistemology in the tradition of Ludwig Fleck (1986), Thomas Kuhn (1962) and Georgio Agamben (Agamben, D'Isanto, & Attell, 2009) may have been put first in the list of additional scientific frames of reference yet what makes them so valuable for the research is not only looking at the scientist's paradigm but much more at the ecology of paradigms that is used in the field to give rough answers to communities of practice (Klein, Forthcoming). The intriguing inside that comes along the notion of ecology of paradigms is, that for example managerial practices should not be thought of as being homogeneous. Different cultural means and different activities within a practice are heterogeneous and may relate to each other in ways which go all along the scale of ecological coexistence from conflict and competition on the one side and symbiosis on the other side. This feeds the notion that the paradox in organisational practices is the rule and not the exception.

Anthropology and Ethnography are listed last but not least. Understanding cultures remains a difficult exercise if I only refer to the latter works of Trompenas (Trompenaars & Hampden-Turner, 2004; Trompenaars & Woolliams, 2003; Trompenaars, 1994) and Hofstede (G. H. Hofstede, 1984; G. Hofstede, Hofstede, & Minkov, 2010). The key to understanding cultures rather lies with the anthropological classics of Norbert Elias (1969, 1982), Bronislaw Malinowski (1923), Johan Huizinga (1939) and Marcel Mauss (1925). Likewise valuable are the ethnographic works of Harold Garfinkel (1984). Especially for the cultural dynamics of self-observation and self-description of social systems anthropology and ethnography serve as a strong frame of reference.

2.1 Methodological Frames of Reference

On the methodological level we only want to highlight the schools of thought rather than going into the various details of research methodologies. These three schools of thought are multi-disciplinarity, design thinking and system dynamics.

Multi-disciplinarity has a long tradition based on trans-disciplinarity and interdisciplinarity. The notion of multi-disciplinarity as a co-creation of different disciplines overcoming systematically the limitation of the single disciplines and co-creating emergence in their interplay became a hallmark of our research practice. Multidisciplinarity links into the tradition of holistic thinking and is very much reflected in the use of tools like lateral thinking (cp. De Bono, 1973) and mind mapping (cp. Buzan & Buzan, 1993).

Design thinking was hyped in the last ten years. The methodological tradition however is much older and dates back to the works of Rowe (1987) and Buchanan (1992) in the late 80ies and early 90ies. Especially for fieldwork and action research, tools like rapid prototyping or micro anthropology are very valuable. In the last two engaged knowledge creation on the spot including systemic reactions to that very knowledge.

System dynamics link to the work of J. Forester, Peter Senge and Frederick Vester. Especially in reference to cybernetics and systems thinking as a scientific frame of reference, tools like causal loop diagrams or simulations (cp. Forrester, 1961; Senge, 2006) allow for a better understanding of the specific dynamics of specific social systems.

2.3 Disciplines of the Field

Disciplines, last but not least, are included here as the traditional descriptions of the relevant fields. For the research of SEgroup as a special organisational development, change management and project management. Overall the reference to a professional discipline comes at the cost of drowning in oceans of handbooks and how-to literature. This makes it difficult to identify the major works and even more so the recent advances.

Organisational development looks gratefully on a rich tradition of research and seminal work seeking to understand organisations. Development, learning and management shall be highlighted in three sub-categories, which feed on a rich discourse driven by key figures like Kurt Lewin (1963), Edgar Schein (1980), Charles Handy (1993), W. Edward Deming (1982), Chris Argyris (1990) and Peter Senge (2006).

Change management as a discipline is a mess. Building on the foundations of organisational development, change management proliferates into all kinds of idiosyncratic perspectives suggesting different recipes to manage change. So the focus is more on change processes like suggested by Kotter (1996) or tools like Appreciative Inquiry (cp. Cooperrider & Whitney, 2005) or Open Space (cp. Owen, 2008).

Project management on the contrary, seems to be refreshingly in order. The hallmark for project management as a discipline is the idea of hedging a body of knowledge, where the knowledge of the discipline comes together and is taken care of. Apart from that we see two large world organisations with the Project Management Institute (PMI) and the International Project Management Association (IPMA) that provide various platforms for the discipline to integrate and to last but not least fairly successful academic journals the Project Management Journal (PMJ) and the International Journal of Project Management (IJPM) can be seen as the chronicles of a well-managed profession.

3. Milestones of the Journey

There have been a lot of milestones on the learning journey of the SEgroup. The operating model of SEgroup pursues the unity of research and service practices. In this way we want to distinguish between two perspectives: one is more looking at methods and tools and the other add processes.

3.1 Methods

Methodologically, systemic inquiry (Klein & Weiland, Forthcoming; Klein, 2004, 2005) was SEgroup’s first application where research and consulting came together in a very fruitful way. Already in the early days of SEgroup there had been applications of systemic inquiry in change management assignments to access the systemic readiness for change of the relevant social system exploring not only the status of a social system or an organisation but furthermore the realms of possibilities within that very system. There had been publications and revisions on systemic inquiry over the years and just recently a critical reflection, balancing and reinforcing the initial idea of facilitating organisational self-observation and self-description pointing at social systemic emergence which serves as a fermentation process in which the individual contribution does not have to be a factual statement to be a valuable input to the process. This is to say it is not really relevant if people lie in the course of a qualitative interview. The relevant information is in the pattern over all interviews.

Process facilitation is a valuable self-description of change management processes which allowed referring to inner structure as in change design and change architecture and giving credits to moderation as the key balancing activity. Linking to group dynamics, process facilitation not only took into account the technical aspects of change but much more than that human dynamics as they occur in social systems and the psychology of change (Klein & Wong, 2010; Klein, 2012b).

The latest logical advancement can be rendered to the headline 'agile change project management'. Especially in order to meet the social complexity of change projects (Biesenthal & Klein, 2013; Klein, 2008, 2012a), agile project management offers valuable possibilities. This relates to the different requirements of organisations to as well described projects in a classic way, for example for procurement processes, as to describe projects in their procedural capacity to deal with complexity, for example in the logic of a continuous stakeholder management.

3.1 Tools

On the level of the tools a set of five can be described as being extraordinarily beneficial for the work of a think and do tank: The TPC-matrix, mind mapping, wall paper reviews, rapid prototyping and visual thinking.

The TPC-matrix is derived from works of Noel Tichy (1983). In our work it had proven to be the key of levelling social complexity through distinguishing very different ideas of organisational activities: a technical perspective, a political perspective and a cultural perspective.

Mind mapping has been without work since the very beginning. However, it was not before the middle of the last decade that we were able to work with mind maps on site. Today the work with mind maps goes without further notice.

The wallpaper review as a tool was developed in the field of academic writing; however it sprang over to any kind of documentation and presentation done within the SEgroup. The idea of the wall paper review is to stick a document or a presentation, paper by paper, slide by slide, chapter by chapter to the wall allowing to access the structural balance and aesthetics within communication.

Rapid prototyping as we included it into the work of the SEgroup was lesser inspired by design thinking, it was much more derived from a systemic solution orientation in change management practices. It is using pragmatism as a process and project accelerator.

The tools of visual thinking proved to be very beneficial on the research side. The graphical mapping of arguments and their arrangement is a quality enhancer. Only a clear line of arguments can survive the graphical challenge.

4. Flow of the Journey

Process thinking is in some way a methodology in the making and has yet reached the tradition of the other three. It has developed as from a milestone to a meta-flow of the learning journey: reflected upon with systemic theories, it has nerveless become more than a method used in change management and organisational development (eq. Goldratt, 1999). Inspired by quality management, process thinking aims at a systematic and integrating approach to specific sets of activities (cp. Bauder & Weiland, 2013). Inspired by quality management, process thinking aims at a systematic and integrating approach to specific sets of activities. Here, four areas of process thinking shall be highlighted: project management (pm) processes, business management, process innovation and supervision..

4.1 Project Management Processes

Integrating project management into consultant research activities seems to be a natural thing out of a project management perspective. Change as well as research, usually comes in the form of a project. Those fields however, consulting as well as research, developed with a tradition focused on individual excellence and seniority. Unless the activity landscape is segregated, along the lines of project management, cooperation, co-creation and quality management turns out to be a burden to some. Viewed from another ankle, it proved that even the integration of project management basics comes as an innovator for quality and results. Especially on the change management side of SEgroup, the focus on project management allows for teamwork where even junior professionals can substantially contribute to the project success.

Combining classic project management and agile project management in change projects seem to be the next level after integrating project management into SEgroup's change management and research. Once project management as such is established, agile project management can be integrated to meet especially the social complexity, the political and cultural aspects, which usually dwell in the blind spot of scientific management.

4.2 Business Processes

The set-up of business processes works into the same direction like the integration of project management. For SEgroup over the years business processes proved to be performance enhancers: The books process, the white paper process, and the self-initiated projects process.

The books process describes the life cycle of a change project, it starts with a white book looking at the stakeholder landscape and change readiness resulting in a so-called white book which serves as an input to the blue book which is the elaborated offer following the requirements of the Logframe. Triggered by the actual assignment, project management perspective of the Logframe switched over in the so-called orange book into an agile project management logic embedded in a rigid project monitoring and controlling. The closure of a project results in the so-called black book. The black book sums up the lessons learnt and reflections of the change project and prepares them for dissemination and stakeholder community.

The white paper process looks at SEgroups' research. The idea behind this process is the acceleration of academic work. The white paper process starts with a research note which is published on the SEgroup website. The research note reads like an extended abstract and serves as input for academic conferences and for white paper drafts. The white paper draft is a provisional academic paper, which is targeted at conference proceedings. In the process of gathering two to three conference presentation feedbacks the white paper draft is developed into a full-fleshed academic paper which is published as a white paper onto the SEgroup website until it is transferred into a peer-reviewed publication. In this case the white paper is taken from the SEgroup’s website and substituted by an abstract at the actual academic presentation.

The self-initiated project process is the latest entry in the SEgroup business process landscape. The standard format for commercial change management projects is the assignment. Consulting comes as a service. A business model is time for money. The various attempts to develop this change management as a service business model into a more entrepreneurial business model which is explicitly exposed to share risks could not be established so far. SEgroup's answer to that was to venture with its change expertise into the field of social entrepreneurship. In essence, the self-initiated project processes is very close to the books process. Only what is described as a white book in the books process becomes more prominent and follows a different inner logic. The major aspect in that is to distinguish between a concern, a pool of ideas and a project, the systemic perspective this is to say is a loose coupling between the concern as the reason why for the project and the pool of ideas comprising so to speak the Lego blocks of a potential project and finally loosely coupled the project as specific configuration of a selection of ideas. In this logic projects can fail even in an as early stage as failing to find funding without damaging the pool of ideas or the actual concern. This approach gives the freedom to fail and to learn in a rapid manner, minimising the involved risks and maximising knowledge creation.

4.3 Process Innovation

Next to integrating project management and business processes there are two characteristic process innovations to be identified along the learning journey of the SEgroup, which is first the chain of exploring mapping trading and second reflection in action.

The train of exploring mapping trading plays with the image of overseas trade in the times of Christoph Columbus. Exploration and discovery marks the first stage in a change project we are looking at the stakeholder landscape and the change readiness. Mapping visualises knowledge out of the first step and allows for broader communication. In the third step we can build on the mapping and identify possible routes and decide upon the course to steer. For change projects we look at the necessity of exploring social systems and the dynamics of organisations. A rigorous academic approach to research as a basis of any kind of exploration makes all the difference and allows for quality.

The idea of reflection in action has been around for a longer while. So here we are looking at a specific SEgroup interpretation, which links the idea of reflection and action not only to action research but to autoethnography and discourse analysis. Autoethnography shall not be too surprising for a think and do tank. Self-application is a question of integrity, discipline and rigour. It allows for critical perspective and prohibits a generic drift towards the identification with the role of the mere consultant or researcher. In a think and do tank you do not want to go native.

A discourse practice analysis shall be distinguished from discourse analysis by allowing to analyse the debate of managers about books they haven't read to reference their managerial practice. This is to appreciate the relevance of these discourses and acknowledge their dynamics.

4.4 Supervision

Supervision, last but not least, is included systematically in the operating model of the SEgroup as the dominant means of quality assurance. Supervision acknowledges that the person with its mental models, skills and experiences is the starting point for any meaningful practice. This ranks from the mandatory training in group dynamics over coaching and peer-to peer evaluation to classical settings of inter-vision and supervision. Linking this to process thinking allows for systematically stabilising these practices without interfering into the actual content, which may touch upon privacy and shall be safeguarded to allow for personal development.

5. Co-Creating the Journey

The journey of SEgroup has never been an isolated one. The principle of co-creation has gone beyond internal cooperation and lead into the creation of a conscious self-reflection to be part of a global stakeholder community.

5.1 Co-Creating Quality

We may call it a four-eyes-principle. In the field as well as in the reflection we realised that there was an immense quality leap going from one person to a team of at least two persons. The net benefit, however, of adding a third person to the team was more with distributing the work load than with actually gaining substantial benefits on the quality. For the white papers of the Group that sums up in the maxim to always have a co-author. From a systemic perspective, a set of two authors does not only allow for two perspectives on the first level of observation. It allows for an observation according to second order cybernetics. It allows for observing observations. So the position of the second observer does not only observe what is observed. More than that it allows observing how the observation is done. This leads us back to the importance of reflecting the mental models and frames of reference the research is based on.

5.2 Co-Creating Discourse

At another level of co-creation international research association or disciplinary practices come into the play. For the work of SEgroup three fields have been exceptionally fruitful: project management, system sciences and critical narratives. Next to these, we were over the years lucky to participate in special single topic conferences.

5.2.1 Project Management

The international discourse on project management can be best observed at conferences and meetings of the PMI, the IPMA and especially with the International Centre for Complex Project Management (ICCPM) and the International Network on Organising by Projects (IRNOP). As already remarked the hallmark of project management as a discipline is its dedication towards a body of knowledge. Evaluating and integrating new models, methods and instruments seemed to be an on-going concern. Especially ICCPM and IRNOP push the limits and sets a benchmark for a contemporary state of the art in project management research, which aims at integrating perspectives far beyond engineering and management. Although attending the single PMI or IPMA conference may be sobering regarding the expectations what take-away could be harvested, the interesting perspective is, like in a second order observation, the analysis of the project management discourse over the years. Different topics have a different life span. New ideas come and go. And others are actively ignored or marginalised before they finally make into the discourse or pearl off.

5.2.2 Systems Science

System sciences in contrast to project management appear fragmented. They are not really looking at a discipline with immediate professional application. For SEgroup, four platforms have been proved to be very valuable: the annual meeting of the International Society of the Systems Sciences (ISSS), the tri-annual meeting of the World Organisation of Systems and Cybernetics, the bi-annual European Meeting for Cybernetics and Systems Research (EMCSR) and last but not least the yearly meeting of the International Sociological

Associations Research Committee 51 on Sociocybernetics. It`s again the discourse pattern over the year which gives an orientation for SEgroup`s own research, especially in the field of social complexity. And it occurs as a parallel to the project management discourse to see to which extent the self-description as a science seems to make it difficult to include the individual as a whole person into the focus of the research.

5.2.3 Topic Conferences

In contrast to the above-described three scientific discourses, topic conferences crystallise different perspectives to co-create upon a chosen subject. There are general symposia or forums like the St. Gallen Symposium or the Tällberg Forum, which try to re-visit the global agenda year by year and facilitate an extraordinary exchange between theory and practice. Out of the more specific conferences, two on the subject of cross-cultural encounter were outstanding: Leadership and Managment in a Changing World and Managing the Asian Century. Leadership and Management in a Changing World was a conference held in 2011 in Athens. The idea was to derive learning from the encounter of the philosophy of Aristotle and the teaching of Confucius. The result of the conference, however, was not so much a praise of the ancient philosophers as the sober insight that the individual experience of globalisation calls for rethinking philosophy. In 2013, Managing the Asian Century, held in Singapore, recommended to let go of our mutual stereotypes concerning culture and philosophy. While Asia is importing cultural memes from the west at a rapid pace, the west seeks inspiration and salvation in Asian spirituality and philosophy.

And although all this discourse observation and conference participation may be not called co-creation in a direct sense, it very much facilitates the co-creation with the relevant context. And from SEgroup`s perspective, the discourse contribution follows the process of exploring, mapping and trading, which allows for a strategic perspective beyond the immediate benefits of reflection and research.

6. A current research example: CCCPM

In 2009 SEgroup launched together with the International Centre for Complex Project Management (ICCPM) a research project on cross-cultural complex project management (CCCPM). It was integrated into the research agenda of the ICCPM as research group number one on social and cultural complexity. In a multi-disciplinary way, CCCPM combines currently twelve PhD projects looking at project management from alternative perspectives. The idea is it to enlarge the project management discourse and allow for a wider space in which the issue of complexity in project management can be enlightened and new models, methods and instruments for practitioners can be conceived. As an illustration eight projects may be listed here:

The first project is a discourse practice analysis looking at the discourse dynamics of complex project management. This is participative research comparing the mainstream project management discourse with expert opinions and the alternative discourse on agile project management.

The second research project brings together Jungian psychology and project management and looks at the shadow of project management. This research is organised in the form of a personal learning journey, starting at the level of individual shadow work, climbing up the letter to reflect not only organisational perspectives but also the implications for the project management discourse.

The third research project is a case study that brings together research about the social change and project management. Looking at social change projects in Brazilian favelas, the research explores to which extent project management is actually beneficial for facilitating social change.

The fourth research project looks at the idea of crowd-sourcing project management. The question is pursued to what extent the management of a project can be crowd-sourced and distributed amongst several independent agents. The research is an auto-ethnographical study reflecting the international growth of a company for coaching services.

The fifth research project switches over to the perspective of arts and looks at the context dependency of project management in the field of site-specific art projects. The assumption is that the specific context suggests a specific way of managing projects.

Project six is another perspective on the arts and looks at the leadership of dance ensembles. The focus is on choreography as the orchestration of complexity throughout the different levels from the single dancer and the pair to the dynamic interplay within the ensemble on stage.

Project example number seven looks at the culture of development projects and explores to what extent development projects in international aid contexts benefit from applying project management beyond reducing the Logframe to an accounting instrument.

Last but not least, project number eight looks at culturally adapted and localised project management education and certification at the level of vocational training. This is a wider issue of context dependency. Next to the cultural aspect comes the challenge of the political balance of east and west, north and south, rich and poor. The project pursues the idea that project management as an approach can be linked to the cultural heritage of a region, a nation or a people beyond the established toolboxes, hence providing accessibility and balance for PM in vocational training at the full range from employability to micro-entrepreneurship.

The CCCPM research project illustrates that research leading the project management discourse does not necessarily have to be theoretical. On the contrary, the CCCPM project shows that multi-disciplinarily and action research allow for break-through, to an extend which is hardly possible from within a disciplinary paradigm.

7. Lessons Learnt of the Journey

The learning journey of the SEgroup did not come to an end yet and it will not allow itself to retire. At the time of writing this short reflection on the praxeology of applied research, six lessons learnt describe the essence for a praxeology of applied research so far: think and do, know thyself, mind the context, create your own meaning, co-create, and be bold:

Think and do

The idea of a think and do thank reflects very much the possibilities of a praxeology of applied research. Reflective action research is not only quality assurance in the field. It allows observing an open and still accessible future. It is a research in a situation where the future is still meaningful in the sense of Niklas Luhmann (cp. 1984). It is a situation where there is still a warm and lively representation of options, which will after the case be cold and pointless.

Know thyself

Know thyself is a starting point of any fruitful reflection. Knowing your mental models and your frames of reference allows evaluating implications against alternatives. And this not only accounts for the research in a much broader way but accounts for praxis, too.

Mind the context

Mind the context as well. First, it is a matter of exploring, mapping and trading, second it is the appeal to curate it. As in organisations we may want to rely on the extraordinary and outstanding researcher as the heroic individual. We have learnt, however, that the quality of any research is with its context. Organising for applied research looks at structures and processes to support it and at agile research management leading even B-players to A-performance.

Create your own meaning

Meaning-creation is the basis for innovation. Try not to be boxed in by fashionable school of thoughts or categories. If you personally can apply aspects from different scientific frames of reference, methodologies, disciplines, even stories for your own work, go for it. In this sense: mind your thoughts for they create your world.

Co-create

Co-creation may be a claim for interpersonal cooperation and for teaming up. Allowing for second order observations, not only looking at the “what” but also on the “how” of the research and its quality. However, co-creation calls for co-creating with the context as well. Know the context of the discourse and this is not only what people have written about the subject. It is much more the applied discourse praxis analysis. As in a conference, it is not so much interesting what is presented. It is much more interesting to see the reception of the presentation and the conversation that points at the presentation.

Be bold

Be bold! Dare to challenge, dare to fail, dare to learn. Any research that does not dare to challenge the existing thinking and practices is pointless. It is all about new thinking and alternative practices. It`s nice to be successful. It is nice to prove one`s initial hypothesis. But this it is just reconfirming what you already know. Learning thrives on failure. And mind that also learning has a technical, a political and a cultural perspective. The Ouroboros bites its tail and we may well start all over again.

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The WELTribe: project prospects, plans and promise

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Keywords: thrivability; systemic sustainability; evolutionary learning tribe; flourishing

1 The WELTribe

In essence, the World Evolutionary Learning Tribe is a fellowship of global thrivability initiatives. It connects and interrelates systemic sustainability initiatives from around the world in an emergent transcommunity based on learning and sharing insights on how to live in dynamic harmony with each other and the life support systems of our planet. The ongoing development and structuration of the WELTribe is an organic process of guided autopoiesis that seeks to emerge conditions favorable to a global eco-civilization.

This project is comprised of three stages:

1. The first stage identifies specific thrivability initiatives around the world that manifest and cultivate the principles of systemic sustainability, either implicitly or explicitly. These principles are as follows:
    a. Intra-personal sustainability; thrivability at the level of personal wellbeing.
    b. Inter-personal sustainability; thrivability with one's communities and social systems.
    c. Trans-species sustainability; thrivability with the more than human world
    d. Trans-generational sustainability; thrivability with past and future generations

2. The second stage connects these specific thrivability initiatives by way of a technological platform that allows them to share experiences, learn from each other, and support one another.

3. The third stage creates system models that represent the dynamics of these specific initiatives and facilitate their rapid prototyping in diverse communities poised to move to the next stage of thrivability as part of the glocal WELTribe initiative. This stage makes use of the previous two stages to emerge the bases for a global eco-civilization.

The WELTribe is both holarchic and fractalic, with natural affinity groupings that emerge within discrete geo-cultural areas of operation. These areas are identified as Regional Evolutionary Learning Tribes (RELTribes), of which there are a total of seven that collectively comprise the WELTribe. Each RELTribe emerges as a cluster of socio-culturally aligned geographic regions within which affine national entities, organizations and communities operate. The overarching *Weltanschauung* and cosmovision of a given RELTribe generate a coherent normative operational framework that best incubates the various specific thrivability initiatives in each region.

At EMCSR 2014 we will present a sample of the specific initiatives of the WELTribe in terms of the first stage of the project, as described above. To do so, we will draw upon representatives from the seven RELTribes to share information about, and advances in, specific thrivability initiatives in their region. Background information can be found here — http://cielcolab.com/reltribes/.

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PhD Colloquium

Chairs

Alexander Laslo (ISSS)
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Scientists of pre-doctorate and early post-doctorate stage are encouraged to present and discuss inter- and transdisciplinary research papers at the special EMCSR 2014 PhD Colloquium & Award scheme. The EMCSR 2014 PhD Colloquium & Award (EMCSR PhD Day) is designed to facilitate the distribution and discussion of inter- and transdisciplinary research work of pre-doctoral and early post-doctoral scientists in all fields within the scope of the EMCSR 2014.

Michael Braito, Marianne Penker, Andreas Muhar, Courtney Flint, Marianne Penker, Flint: Governance of environmentally friendly energy behaviour and its (intended) effects

Andreas Hieronymi: The structure of complex situations: multidimensional concepts and visual representations

Vahid Moosavi: Beyond rational modeling

Katri-Liisa Pulkkinen: A bottom-up way of building a system and changing perceptions: urban pioneers as a model for transformation for sustainability

Edmond Ramly: A functional model of evaluation for a global learning health system

Duygu Uygun Tunc: A new ground for analogy: an epistemo-ontological study of systemic principles

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Governance of environmentally friendly energy behaviour and its (intended) effects

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Keywords: socio-ecological system, governance strategies, energy behaviour, values, concepts of Human-Nature Relationship

“Mankind has now entered the Anthropocene, the era in which human activities play as significant a role in shaping the biosphere as do natural processes” (Perez 2006 p.xi). Although we deepened our understanding of how and why people choose to behave, it is not yet fully clear how to encourage environmentally oriented behaviour in order to minimise unintended impact on nature. As we saw in Warsaw at the 19th UN-climate conference (COP19) in November 2013, it is challenging to change the present energy system to reduce CO2 emissions significantly. Energy is closely linked to economic development and growth and therefore intensively discussed. Nevertheless, it is recognised by the parties of the COP19 that:

> *”Everyone of us may contribute to stopping or, at least, limiting the climate change. These actions do not require expert knowledge or a lot of time or money, it is enough to bear in mind the best interests of the natural environment when making everyday decisions” (Masson et al. 2013 p.20).*

But societal changes are sluggish and according to Jager et al. (2000) this is part of human nature. Apart from that, rational self-interest often dictates environmental exploitation, although we know that we would be better off if the environment were protected. It seems that current measures to trigger a behavioural change are too week. One explanation could be that sustainability discussions do often concentrate on environmental and economic concerns and little on socio-psychological aspects of behaviour, such as ethics, norms, and values, “which are strongly related to the stability and direction of a society” (Hondo and Baba 2010 p.229). Moreover, socio-ecological systems are characterised by very long-term interactions between humans and their environment, displaying learning, adaptation and complex non-linear feedbacks (Perez 2006 p.xi). Therefore, to provide a coherent analysis of these complex, nested systems operating at multiple scales (Ostrom 2007), Hirsch Hadorn et al. (2006 p.120) claim researchers to “[…] reflect the diversity, complexity and dynamics of the related processes as well as their variability”, in order to produce relevant knowledge for sustainable development.

The overall aim of this paper is it to address the relationship of governance strategies with individuals’ motivation to change their energy behaviour, in order to accelerate a transition towards more sustainable energy behaviour. Environmental governance is known as a set of regulatory processes, mechanism and organisations that includes all institutional solutions for resolving environmental problems (Lemos and Agrawal 2006; Paavola 2007). Mechanism and strategies of environmental governance are the result of the interaction of the state, the market and the community. In other words, the state, the market, organisations, civil social groups and their rules all influence, directly and indirectly, the direction of a society. Of particular interest for the research objectives are entirely different governance approaches: stimulating individual versus collective engagements in photovoltaic projects.

In the paper I will discuss a comparative case study of two different photovoltaic governance strategies for the following reasons. First, apart from small-scale wind turbines, photovoltaic belongs to those technologies of renewable energy production that can be easily adopted by individuals and small groups. Second, people can decide freely if they engage in this technology or not. Thus, the individual or collective choice making process can be observed and analysed. Third, photovoltaic has an additional socio-psychological effect. Thus, spillover-effects can be observed (Thøgersen and Ölander 2003). Individuals have the opportunity to make statements about their environmental beliefs (communicating their values or protesting against the energy monopoly). According to Hondo and Bada

(2010) the installation of photovoltaic systems in a local community increases communication among family members and neighbours regarding environmental behaviour and consequently promotes environmentally friendly behaviour.

In Italy for instance, supporting individual household engagements was the main strategy over the past years (Focacci 2009). As a result investing in photovoltaic became an attractive strategy for private households and resulted in a huge increase of energy produced by photovoltaic (Corvinelli 2012). After several years of economic incentives in place, new investments in photovoltaic are now stagnating, if not even decreasing since the state support in Italy terminated with the end of 2013. In the case of citizenship engagements in Austria (i.e. collectively owned solar power plants) other motivational driving forces seem to play a crucial role. Instead of self-enhancement by economic benefit, it appears that participants seek for benefits such as contributing to a better future for our children and becoming independent from big energy market players.

In the paper, I will introduce different theories from diverse epistemological backgrounds (psychology, sociology, and economy) and compare their explanatory value for environmentally oriented energy behaviour. As a result a system model of behaviour and its governance is derived, which incorporates governance strategies, energy behaviour, motivation for behavioural change, and socio-psychological patterns like concepts of Human-Nature Relationship, values, attitudes and norms. Out of that model a research framework is derived and applied in the comparative case study. Exploratory interviews have been conducted in Austria as well as in Trentino-Alto Adige/Südtirol (Italy). The interviews serve to explore the relationship of governance strategies with individuals' motivation to change their actual energy behaviour (production and consumption). Data are analysed by using the directed content analyses. As the analyses is not yet fully completed, preliminary results are reported. However, the first results do promise interesting conclusions. It seems that governance strategies do not only have the intended effect, but also an unintended effect on socio-psychological patterns. Additionally, it seems that changes in energy consumption cannot be observed on the same degree when people engage in collective solar power plants compared to those investing in their own plant. As Adger et al. (2003 p.1007) argue "[…] a greater understanding of how environmental decisions are translated into governance outcomes is important for policy purposes."

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The structure of complex situations: multidimensional concepts and visual representations

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Abstract

Complex situations cannot be understood by looking at one single aspect alone. Multidimensional concepts allow for better structuring and understanding of complex situations. A special focus is given to a rather new multidimensional concept called VUCA (volatility, uncertainty, complexity, ambiguity), that is gaining increasing attention in the business world. This paper tries to explain methods that are useful for visualizing dimensions of complex situations and to highlight skills for improving to deal with such situations.

Keywords: complexity, volatility, ambiguity, uncertainty, systems theory, systems science, management, strategy, visualization, leadership development

During the last decade it has become evident that we live in a time of increasing change and uncertainty. Recent events opened up a broader interest to better understand the nature of processes in social systems as well as to rethink traditional approaches of situation analysis, forecasting, planning, and decision-making. Understanding the world through looking at processes isn't a new. Among prominent thinkers who emphasized process, flux, and transformation are: Heraclit, William James; Henri Bergson; and Alfred North Whitehead (Nayak & Chia, 2012, p, 281). There are as well some well-known organization theorists who emphasize in their work a process view: Weick's sensemaking; Mintzberg's process approach; James March (Langley & Tsoukas, 2010, p. 8). Process theory and complexity theory can be hard to understand. VUCA facilitates reasoning about complex situations, especially in relation to management and strategy.
Figure 1 relates VUCA environments to organizations and employee behavior.

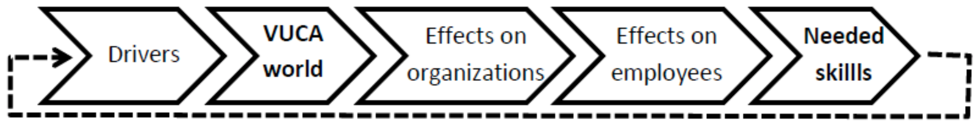

Figure 1. The drivers of VUCA might lead to individual behavior that can reinforce the drivers of a VUCA world.

Drivers of a VUCA world include for instance "technology, digitization, connectivity, trade liberalization, global competition, rapid copying, growing entrepreneurship, business model innovations, the increasing power of top talent, the success rate of innovative firms" Sullivan (2012). This environment requires a different mode of decision-making in organizations.
Aspects of VUCA (volatility, uncertainty, complexity, ambiguity) - The term VUCA emerged in the US army and has since found its way into management literature. Shambach (2004, p. 12-13) provides the following explanations for the four VUCA aspects.

- **Volatility:** "Volatility refers to the rate of change of information and the rate of change of the situation."
- **Uncertainty:** "Uncertainty stems from the inability to know everything about the current situation and the difficulty of predicting what the effects of a proposed change today will be on the future."
- **Complexity:** "There are an enormous number of factors that have causal baring on a given situation."
- **Ambiguity:** "Ambiguity exists when a decision maker does not understand the significance of a given event or situation – doesn't know what is happening. […] Ambiguity can also occur when an event can legitimately be interpreted in more than one way."

VUCA and its relevance for organizations. Situations where many factors are in a VUCA state might be, for example, in the situation of start-up venture or when entering an unknown market with new products. The following elements are related to aspects depicted in the St. Gallen Management Model (Ulrich & Probst, 1995, p. 54). Very challenging situations might look like this:

- The (social, political, economic, technological, etc.) environment is dynamic, complex, ambiguous and uncertain
- The customer group is dynamic, complex, ambiguous and uncertain
- The services / products are dynamic, complex, ambiguous and uncertain
- The employees are fluctuating, hard to predict, have complex interactions, are hard to judge

Skills required to deal with VUCA situations. As the concept of VUCA is still relatively new, there is no established view of what skills are needed for employees to deal with VUCA situations or what leadership styles are to be applied. Suggestions vary widely between authors. According to Manawi (2013), a VUCA world needs “a new kind of leadership that is value-led and purpose-driven and leaders who can redefine the role of business in society” (p. 11).

Theoretical foundations and practical applications

It is beneficial to strengthen the theoretical foundations of VUCA and relate them to concepts of earlier traditions of systems science, such as open systems theory (Bertalanffy), cybernetics (Wiener, Beer) and chaos theory (Lorenz, Mandelbrot). A next step involves determining different kinds of visualizations to enable better understanding of complex situations. Finally it is important to define skills that enable managers to better deal with specific kinds of complex situations. We can formulate the following questions for further clarification:

- What alternative multidimensional concepts exist that are similar to VUCA? What are their strengths and weaknesses and their special area of appliances?
- What are the psychological aspects which make it difficult to deal with VUCA dimensions?
- What kind of graphic means help to visualize and make sense of complex situations?
- How do managers conceptualize and differentiate the four sub-concepts of VUCA?
- What skills are needed to better deal with these aspects (volatility, uncertainty, complexity, ambiguity) and how can they be thought?

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Beyond rational modeling

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Formalizing the concept of modeling, as a systemic task has been a great contribution of systems science, which has developed a common language to connect classically separated disciplines (Klir, 1985). However, despite major critiques such as Ackoff (1977) and Lee (1973) during last decades, availability of computational technologies has created another diversified landscape of modeling disciplines, in which each model, as a pair of glasses, views the real world problems based on a certain perspective. For example, *Network Analytics* is a structure oriented and infrastructural thinking view to the world (Hillier, et al.,1976) or *System Dynamics* (Sterman, 2000)) with a process oriented view focuses on dynamic complexity of causal relationships. Further, *Agent Based* models (Axelrod, 1997) view the real world phenomena as emergent outcomes of interactions among different agencies. Based on the challenges in modeling complex systems, this diversity might be seen as a competitive ecosystem of different modeling species with different capacities and trade-offs in dealing with complex phenomena. However, despite this technical diversity, the main hypothesis in this paper is that from an abstract point of view majority of existing modeling approaches are following the same paradigm of modeling that we call *rational modeling* and the first goal of this work is to show the fundamental limit of rational modeling in dealing with complex real world phenomena.

One of the main problematic underlying assumptions in rational modeling is that there is an "*ideal model of the object of inquiry*" and the modeling process, is an endeavor to find a representation of this ideal object with maximum accuracy and minimum complicatedness. In order to elaborate on this, we discuss the story of elephant and the blind men, in which these men are asked to identify the elephant just by touching its body, while they have no pre-conception of the object. In the literature, this parable is used to show the advantage of systems methodology over multi-disciplinary or single disciplinary views for identification of the elephant (Gharajedaghi, 2011), but our focus is that regardless of the power of each individual modeling approach, the fundamental assumption behind this story is that there is something solid as "elephant" and the goal of the rational modeling is to find its best representation. However, the question is what if this whole (elephant) is not fixed, which is the case in complex adaptive systems? Or how is it possible to "engender the concepts instead of representation?" (Buhlmann, 2013).

From a mathematical point of view, this fundamental element of rational modeling can be explained by the notion of "abstract universals" in set theory, in which to have a set of concrete instances (e.g. set of red apples), one needs a super-class that defines the ideal properties of that class and this requirements initiates a never ending hierarchical process of defining abstract universals for the higher order classes (e.g. a set for colors of apples), as it has been raised by Plato (Ellerman, 1988) and further, can be referred to symbol grounding problem (Harnad,1990). Further, based on a measure of complexity as a function of properties and relations between properties of real phenomena (e.g. a chair comparing to a city as a social system), we show that the fundamental limit of rational modeling approach is the issue of explicit representation of the real objects and consequently in a complex system, any endeavor toward an explicit representation leads either to a complicated model (which can be explained by the curse of dimensionality (Bellman, 1961)) or results to an arbitrary model of the real object, which can be interpreted by Gödel's incompleteness theorem (Raatikainen, 2014).

In the second section of this paper, not in an opposite direction to explicit representation, which is a common approach in social science, but based on the notion of "concrete universals" from category theory (Ellerman, 1988), we investigate the potentials for a new level of abstractions in paradigms of modeling (Buhlmann, 2013). Analogically, an onion like model of number categories explains what we mean by levels of abstraction. For example, with natural numbers one can never grasp the richness of proportions in rational numbers (e.g. 2.3 which is either 2 or 3 from a natural number perspective), while rational and real numbers are capable to handle the situation. Therefore, if a specific rational model is an arbitrary view, what if it is possible to conceptually encapsulate all the potential arbitrary views in an implicit way? The second hypothesis in this work is that concrete universal introduces a turn in the concept of representation from explicit property based representation to an implicit representation of objects in the space between objects, while the relations between individual objects is not based on a given centralized rule set, but rather through a bottom up empirical emergence. In many application areas, this condition holds and therefore we have an emergent network based representation of the object of inquiry, in which the concepts and identities are embedded in the whole network of instances and their empirical relations. This turn has opened up a new horizon in the realm of data-driven modeling in comparison to classical theory-driven modeling. An enabling factor that facilitates this turn is the availability of real time data streams, which has caused an inversion in the concept of observation and sensing from designed sensory systems to a data deluge, in which the data structure is not necessarily defined a priori. To just mention a few, one can refer to new technological frameworks such as ubiquitous and pervasive computing (Greenfield, 2006), mobile computing and crowd sensing (Ganti, *et al.*, 2011). In a technical level, there are promising methods, which support the above-mentioned conceptual turn. We investigate Markov networks (Markov, 1906) for the issue of encapsulation of complex concepts and further, we discuss Self Organizing Map (SOM) (Kohonen, 1982), especially with certain interpretations (Hovestadt & Buhlmann, 2014), as a powerful data driven method for modeling causal relations and structural learning, which abstracts from classical function approximation methods. Finally, we support our conceptual and technical ideas with real stories from urban transport modeling problems (Moosavi & Hovestadt, 2013), social media and Google search engine (Brin & Page, 1998) as well as successful cases in natural language processing and linguistics.

Keywords: *systems theory; rational modeling; representation; data streams; Markov network; self organizing map*

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Vahid Moosavi joined the Chair for Computer Aided Architectural Design (CAAD) at ETH Zurich as a PhD researcher in May 2011. Since November 2011 he has been working at Future Cities Laboratory (FCL), Singapore-ETH Centre. In 2009 he got his Master of Science degree in industrial and systems engineering from Tehran Polytechnic as well as his Bachelor degree in industrial engineering from Isfahan University of Technology in 2006. Despite his diverse fields of practice as a planning and IT management consultant in different sectors, his main scientific research interest has been always around abstract and mathematical concepts for modeling and design approaches. In his PhD research, he is focused on the development of a generic computational modeling framework for urban and architectural design problems, based on Self Organizing Maps (SOM) and Markov Models as core technologies in coexistence with urban data streams with different practical applications such as urban text modeling and sentiment analysis, modeling urban traffic dynamics using GPS data streams and Markov Chains and modeling urban land use dynamics using available data from social media.

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A bottom-up way of building a system and changing perceptions: urban pioneers as a model for transformation for sustainability

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Abstract: The perceptions of the system of itself and of its environment affect the way the system acts, and change in these perceptions can have a paradigmatic effect in the behavior of the system. The study of urban pioneers shows how this kind of transformation is possible from bottom-up.

Keywords: Bottom-up process, complex adaptive system, dynamic emerging system, feedback loops, panarchy, perception of a system, resilience, sustainability, transformation, urban pioneers

The perceptions of the system of itself and of its environment, or the larger system that it is nested in, affect the way the system acts. A change in these perceptions can have a paradigmatic effect in the behavior of the system. This study of urban pioneers shows this kind of transformation, exploring how a newer, smaller, emerging system in a nested panarchy (Holling, 2002, 2004) of a city manages to change the perception of a larger system of itself. The urban pioneering movement in Helsinki is an example of an emergent system formation that has bottom-up influence on the city and its governance that could be seen as a larger, slower cycle in nested panarchies. The urban pioneering movement acts to change the regime of that larger system, without causing collapse. The aim of the movement is to transform the urban culture through citizen-initiated activities that generate a more tolerant and open city with appreciation to citizen demoracy (Pulkkinen, 2013, Hernberg, 2012).

The research is linked to transition to sustainability through the notion that one of the main aims of the sustainability movement is to reach a transformative change in the way people perceive their environment. We should be able to understand our role in the regeneration of the life supporting systems of the planet (Reed, 2007) - the planet's carrying capacity has been already exceeded (Rockström et al., 2009; Wackernagel et al., 2002). The aim of this research is to study whether the urban pioneering movement as successful perception changer could contribute to building a model of what would be needed to make transformative bottom-up changes in the sustainability movement. This question is approached by studying the urban pioneering movement as a dynamic emerging system (Meadows, 2008) in a panarchic setting (Holling, 2002, 2004).

1.1 The urban pioneers

The urban pioneering movement in Helsinki, shortly, comprises of many separate "pioneer projects" that have happened over time (in the research from 1989 - to the current). The movement is a complex, adaptive and open system of several independent groups of people – some individuals might be active in many groups, some in only one. These people are producing new ideas to the cultural scene of the city, mostly some kind of events, or activation of places and spaces (Krivy, 2012, Hernberg, 2012, Pulkkinen, 2013). Over time, the separate projects have formed into a movement that is recognized by the city governance, the public media, and of course also by the pioneers themselves.

Describing the urban pioneer projects as dynamic processes, it could be said that the movement is aiming at creating positive feedback loops – a snowball effect – by producing urban events that create demand for more of a similar kind of action, while they have to work with the negative feedback loops of restrictions and rules that inhibit such initiatives (Pulkkinen, 2013). Over time, the movement has become increasingly successful in their endeavor and they have managed to both create demand for the culture that they create, as well as diminish the amount of resistance caused by the negative feedback loops. This has required a lot of communication with the environment (the city of Helsinki), offering possibilities to communicate the pioneers' perception fo what the city should be.

In addition to these successes, there are some features that explain further how the perceptions are transferred during the system formation and action. These features include the action-oriented attitude, the iterative learning process and the formation of patterns that accumulate into a system.

▪1.1.1 Let's just do it -attitude

A basic setting that has been essential in all of the pioneer projects studied is that the pioneers do not accept their systemic environment – the urban culture - as such, but they perceive it as something problematic that needs change. Further, they reckon themselves to be the actors who can make the changes that they want to see. The pioneers seem to possess a kind of a ”let's just do it” attitude. That attitude with the action that comes with it is what makes them pioneers in the first place; they are the ones that cause change to the system from within.

▪1.1.2 Iterative trial-and error-type action

The way that the pioneers act towards the change that they want to see is not pre-designed, but rather an accumulation of learning through trial and error - an iterative way of doing things. Of course, some system design is present in e.g. organizing events, but the general attitude is open to possible changes and iterations. There is a direction, a magnetic vision of the future that guides the action: the perception of what the systemic environment should be like. It could be said that the movement proceeds forward in an unfamiliar territory… they are sort of ”feeling” and learning their way forward in their projects. This adaptive learning system also changes the environment, as this ”feeling the way forward” does not happen without leaving marks that change the environment.

▪1.1.3 Patterns forming over time – building a new system

As the magnetic vision remains persistent, the repetition of trial and error – or the forward-negotiating way – results into emergence of patterns over time. Success stories are more or less mimicked in new projects, and it is just the communication of those stories what makes the patterns available for those who come later. In fact, this repetition of patterns of action is what starts to create emergence of a system: trial and error and pattern formation are the way that the movement gains momentum, creating a still expanding series of positive feedback loops.

Patterns also ensure that the new system becomes resilient, since over time, the systemness of urban pioneering is more about the patterns than the individual people. In the early days, however, the pattern formation has been very much about individual people, the torchbearers or urban mediators (Krivy, 2012), who were resilient enough to iterate with the process, if they did not succeed at first. Later, the patterns support those who are willing to participate the movement, and individuals have more energy to concentrate on the variations of cultural forms.

1.2 The transfer of perception from pioneers to the city

Over time, the pioneer projects have changed the larger, slower cycle in the panarchy; the territory, so to say, has not only become more familiar for them, but in the course of familiarization they have also changed it. The formation of a system has happened through repeated patterns that have become more efficient over time, and the perception of what the city is and should be has been transferred through action. What was considered originally as a rule-braking behavior of the citizens, has now been adopted and even promoted by the city. From another perspective, the governance of the city has also adapted to its environment; instead of seeing citizen activism as a threat or disturbance in the environment, they start to welcome it as a positive force.

The city now actively engages itself to make it easier for the citizens to be active in an urban pioneering way. For example, in a television interview in November 2013, the mayor of Helsinki laments that there are still too many forms to fill if a citizen wants to organize an event (www.tosielamandiili.fi/startup.shtml/1825046/ravintolapaiva). Also, the city currently (February

2014) uses pioneer-created events in its marketing (www.visithelsinki.fi/en) and in June 2013, the organizing of the main event of the Helsinki day celebrations was ordered from a group of urban pioneers (www.helsingintaivaanalla.fi). The transformation exceeds further to the attitudes and procedures of the city of Helsinki.

These examples visualize how the perception of the environment has been successfully communicated from the pioneers through to the city of Helsinki, with a method of ongoing action and activism. A regime shift process without a collapse, the change has leverage to transform the system from within. This kind of paradigm change process in the perception of “what the system should be” is an example that could offer some guidelines for transformation to sustainability. The paper will explore further the commonalities and differences between the urban pioneering movement and the sustainability movement, suggesting an initial systemic model for generating bottom-up transformative processes in sustainability movement.

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A functional model of evaluation for a global learning health system

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Abstract: We complement from a functional perspective current structural efforts to develop a global learning health system to support systematic accumulation and dissemination of wisdom, knowledge, information, and data about health, with a focus of the evaluation function. We develop Evaluation Mapping Theory, a general model of evaluation and the Evaluation Domain Analysis methodology applied to a case study of health information technology innovation evaluation.

Keywords: Evaluation, Health Care, Learning Health Systems, Purposeful Systems, Normative Models, Function/Structure.

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One of the most pressing grand challenges of human civilization is to ensure the health of all humans by responsibly and sustainably leveraging all available resources. Those resources include all available human wisdom, knowledge, information, and data (WKID) about health and health care delivery. It is ethically imperative to bring all available intellectual capital to bear on every person's health, and the development of Learning Health Systems at the national and global level are key to pursuing that vision.

The purpose of a Learning Health System is to make the best existing WKID available at the point of decision when it is needed in the form that it is needed to inform health decisions by clinicians, patients, or any other involved stakeholders. A critical function of a Learning Health System is thus systematic learning, to support the creation, accumulation, and dissemination of WKID. One particularly important type of WKID where health is concerned is wisdom, knowledge, information, and data that is about value rather than about facts. In a value-laden field like health care, quality of life is at stake and diverse individual preferences must be honored. An effective Learning Health System therefore must be capable of systematic learning about value, which is within the scope of the transdiscipline of Evaluation.

To date, the idea of a Learning Health System has been developed mainly from a structural perspective, with a focus on the Information Technology (IT) infrastructure that would be necessary to support systematic accumulation and dissemination of WKID about health. Practically no attention has been dedicated to examining the requirements of a Learning Health System from a functional perspective. A useful conceptualization from that perspective is that of a LHS as a Purposeful System (Ackoff & Emery) with multiple interdependent functions such as learning, accumulation, dissemination, and evaluation.

The purpose of this paper is to formalize the function of evaluation in a way that supports its role in the systematic accumulation of value-related WKID, and that serves as a common basis across evaluation traditions and perspectives. We use the health care domain and the idea of Learning Health Systems to motivate and frame the work, but normative model developed here is relevant to evaluation in any domain, including but not limited to education, sustainability, innovation, and international development.

We choose to formalize evaluation from a problem solving perspective given the success of problem-based formalizations of similar functions such as optimization and decision making. This choice enables the formal study of problems and solutions separately, which underlies much of the systematic development of engineering knowledge and methods. This formal perspective does not preclude the use of other approaches, including for example problem structuring methods and heuristic-based methods that emphasize process over representation to address messes and wicked problems. In fact, the axiomatic perspective promises to support the development of such approaches in the context of evaluation, as has happened with optimization and decision making, where the complementary approaches were developed in reaction to – and thus anchored and enabled by – the assumptions of mathematical optimization and decision theory, in the form of bounded rationality, heuristics and biases, and naturalistic decision making.

We propose a normative model of evaluation that can support the systematic accumulation of value WKID without stifling the important diversity and innovation in evaluation epistemologies, methodologies, and ontological commitments. The model is limited to the fewest key elements every evaluation can be considered to have while remaining an evaluation. We relax (and thus expand) established definitions of evaluation from the systematic determination of the merit or worth of a program, system, person, or group, to the assignment of value to an evaluand. The three elements of any evaluation problem are thus an evaluand scope, a value scope, and possible ways to assign value to evaluands, within the scope.

We present the normative development of a functional model of evaluation, Evaluation Mapping Theory, develop Evaluation Domain Analysis, a methodology to apply it, and demonstrate it in the case study of an evaluation of a large 4-year health IT innovation project at Harvard Medical School.

The proposed model and methodology constitute a foundational common basis for evaluation discourse and practice across all the disciplines (physical, natural, social, humanities, etc.) and enables the accumulation of wisdom, knowledge, information, and data about value without giving up the rich diversity of approaches to evaluations from different disciplines such as education, nursing, medicine, business, social sciences, history, philosophy, etc.

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Edmond Ramly, MS, PhD (c)

A health systems engineering PhD candidate at the University of Wisconsin-Madison, USA, Edmond conducts theoretically grounded practical research in the evaluation of innovations, with a current focus on health information technology innovations. He has developed a normative framework for the separate formulation of evaluation problems from evaluation studies and methodologies to compare evaluation studies and to evaluate innovation projects without obscuring innovation and unanticipated outcomes. He has been the instructor for the Introduction to Health Systems Engineering course for two semesters. He is a member of the external evaluation team of the Harvard SHARP project and a research assistant at the Center for Health Systems Research and Analysis, guiding the Wisconsin Department of Health Services in the development and evaluation of an IT-enabled statewide public-private collaboration to support and benchmark internal quality improvement in assisted living facilities. Ramly has worked as a process improvement and technology assessment engineer at the University of Wisconsin Hospital, and as a medical logistics research associate at the RAND corporation. In 2010, he co-authored the AHRQ/NSF federal report on the critical areas of research at the intersection of industrial and systems engineering and health care, with emphasis on the supportive role of health information technology (healthit.ahrq.gov/engineeringhealthfinalreport). He obtained his bachelors in Computer and Communications Engineering at the American University of Beirut, Lebanon.

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A new ground for analogy: an epistemo-ontological study of systemic principles

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Abstract: A reconsideration of some major ontological and epistemological questions facing systems research in the light of the Simondonian theory of individuation.

Keywords: Ontogenesis; individuation; analogy; structure; operation; relation; reductionism; unity of knowledge; Simondon

Systems research is predominantly after delineating principles of systems in general, which are to be expressed in forms that are independent of the nature of their constitutions and that enable their transfer from one discipline to another, for the purpose of unifying knowledge at a higher level than that of specialized disciplines.

Some of the main still standing questions in front of systems research, and related problems that demand further theorizing are:

1. How do we account for the genesis of a system by studying its structure and behaviour? Assuming that systems manifest emergent properties, how can an analysis of already formed systems reveal the conditions of their geneses? This problem constantly poses the challenge of accounting for self-organization without resorting to obscure powers which kickstart the process of structuration, like inherent tendencies or primary activities.

2. What is the relation between system as a conceptual construct and system as a real entity?

3. How do we ground the legitimacy of transfer of analogies from one domain to another? The central problem with legitimization of analogy transfer is avoiding false analogies, reduction or assimilation.

All these problems revolve around how we define “system”. The predominant attitude in systems research is to define systems on the basis of their atoms, i.e. the relevant constituents, at a pre-determined level of abstraction, and the types of interactions among them and with systems' immediate environments. Firstly, starting with the determination of atoms introduces conceptual choices, thus risk of arbitrariness. Secondly, the approach of assuming building blocks and rules of combination are paradigmatic of reductionistic mechanicism; thus systems research, in this way, cannot divorce science from its mechanistic baggage. Lastly, relations are treated on the same level with constituents, or as secondary; for this reason there is an intractible problem regarding the primacy-conflict between relations and their terms, we are not given a clue about what comes first ontologically and chronogically, and how first organized entities came about. Moreover, system research widely assumes a hierarchical stratification of reality consisting of nested levels of increasingly complex organization, yet it does not adequately explain, without resorting to teleological notions, the means and conditions of this process. Relations, as conceptualized by systems researchers, are established between entities on rougly the same level; thus how are different levels of organization connected to each other? What is the nature of inter-level relations?

Such problems are centered around the ontological status of relations, and thus of organization. Systems research have progressed significantly in the way of overthrowing the reductionist-mechanicist paradigm but it has not yet brought about a radical shift in the basic ontological framework itself. Actually these problems are inherited from previous paradigms against which systemic thinking fights.

There has been a deeply significant and promising, yet largely overlooked attempt at formulating a new type of relational ontology that can assist systems research in its quest for the unification of knowledge by providing a ground for the legitimacy of analogy transfer between domains, and a framework for accounting for the ontogenesis and historicity of systems without begging the question: Simondon, who formulated his relational ontology just after systemic ideas began to attract attention and controversy, is a figure from whom systems research should benefit.

In Simondon's relational ontology relations are not secondary realities that come after their terms, but primary realities that co-emerge with them. They have the status of being, thus are not accidental but primarily real. Thus the terms “interaction”, “connection”, or “tie” do not cover the sense Simondon ascribes to relation. His theory of individuation provides a relational framework which aims at grasping systems through relations that bring about their geneses. Simondon's central notion, “individual”, is comparable the most with that of “system”, but is more limited in content and extension: every individual is a system but not every system is an individual. Individual, in his terms, is by definition an open system which is the site of an ongoing structuration; thus when stable equilibrium is reached within a system we can no longer talk about an individual but only of an “individuated being”. Individual consists in the very relation, the active exchange between an interiority and an exteriority.

The approach characterizing his philosophy is to understand the individual through its individuation, or ontogenesis, rather than an analysis of its organization. Individuation, for him, should not be conceptualized in terms of composition out of pre-existing elements; it must be understood without reference to any concrete or formal individual, because that would beg the question of what an individual is. Rather, individuation must be sought in reference to pre-individual reality. The common denominator of all modes of individuation is that a metastable, pre-individual domain in suitable energetic, formal and material conditions is triggered by an event of “information”, i.e. reception of a signal of structuration. Upon information, a communication medium between two levels of organization is established whereby the previously independent histories of the entities at the lower level are unified and through the whole which they bring about they are shifted up to a higher level. Individual is this middle-ground of communication, the mediator between different levels of organization; thus it is not conceived as a “construction-upon” but as a “communication-between”.

Individuation propagates within a physical, biological, mental or social domain or from one domain to another “transductively”, that is, through the conversion of structures to operations and operations to other structures. An operation is what brings forth, or modifies a structure; structure and operation are the ontological complements of each other. Individuation is an operation, and it conserves structure: structures cannot connect domains but operations can.

Moreover, transduction expresses the very nature of the process of individuation as well as the method that needs to be followed to grasp its reality. Parallelly, transductive thought transfers the fundamental operations of each domain to subsequent ones, while modifying them in accordance with the peculiar structures and operations of the subsequent domains. The locomotive of the transductive process is analogical operations. Analogy, for him, is a real relation between two operations; it is an epistemogenesis taking place simultaneously with ontogenesis.

Knowledge of structures require knowledge of operations that dynamise them; valid transfer of analogies must preserve the operational scheme of a system. Defining operations by the structures between which they are exercised would risk being reductionistic, especially if the system under consideration can be defined better by what it does more than what it is; since ontogeneses of structures would be ignored. Analytical study of structural aspects of systems, which characterize specialized disciplines, can be securely undertook if the systems in question are stable, established ones which are not subject to ontogenesis. Simondon's relational ontology, in this context, can enable systems research to situate itself and specialized sciences more clearly and elaborately within the whole body of knowledge.

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She has taken her B.A. and M.A. Degrees in Philosophy from Bogazici University. Her M.A. Thesis was on the historical origins of systemic thinking in Aristotelian hylemorphism and its development on the basis of a relational ontology in Simondonian theory of individuation. She studied Chemical Engineering for three years before starting her undergraduate degree in Philosophy. She has attended seminars on, and engaged in the Philosophical study of General Systems Theory, Cybernetics, Chaos Theory and Complexity since 2009. Currently she is a PhD student in Philosophy in Bogazici University, and working on systemic perspectives in Philosophy and Psychology on the emergence of self-hood.

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Theme I
Sustainability and development

About the Theme chair

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André Martinuzzi is head of the Institute for Managing Sustainability and associate professor at the Vienna University of Economics and Business (www.wu.ac.at/sustainability). He has a doctoral degree in general management and a postdoctoral lecture qualification (venia docendi) in Environmental Management and Sustainable Development Policy. His main areas of research are corporate social responsiblity, sustainable development policies, evaluation research, and systems thinking. During the last years, he has co-ordinated projects funded by the EU Framework Programmes, has conducted tendered research projects on behalf of six different EU Directorates General, Eurostat, UNDP and for several national ministries. He designed and implemented an internet-based monitoring system for the 7th EU Framework Programme (www.FP7-4-SD.eu), developed knowledge brokerage tools for sustainable consumption (www.SCP-KNOWLEDGE.eu and www-SCP-RESPONDER.eu) and led a major work package in a project (www.CSR-IMPACT.eu) dealing with impact measurement of Corporate Social Responsibility. In a brand new EU funded project (www.GLOBAL-VALUE.eu) he coordinates the development of a toolbox for assessing multinational corporations' impacts on developing countries.

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I A 1
Disasters: prevention, preparation and response

Chairs

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Awareness and occurrences of disasters have become more acute during the last decades, endangering a growing number of people and areas in many different ways. Even many of the so-called natural disasters often are directly or indirectly caused by ill-guided or even ill-intended human activities. Society needs interdisciplinary and systemic approaches to understand and mitigate/eliminate effects of natural disasters. Today's information and communication technologies (ICT) can support and improve above activities, sometimes in ways not anticipated before. They allow for speedy aggregation and presentation of data and information supported by effective communications in new ways, offering improved systemic interpretation, assessment and decisions.

List of Contributors

Viveca Asproth, Stig C. Holmberg, Anita Hakansson: Improving preparation for disaster management by reflecting on communication patterns
Gerhard Chroust, Georg Aumayr: Process models for disaster management: standardization and assessment
Manfred Fullsack: Resilience and graceful degradation in cooperation networks: experiments with simulated public goods games
Gilles Legrand: Overmind territorial resistance
Christoph Sebald, Georg Neubauer, Sonja Kabicher-Fuchs, Christian Flachberger, Hilda Tellioğlu: The RE-ACTA crowdtasking platform: for crisis and disaster management in Austria

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Improving preparation for disaster management by reflecting on communication patterns

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Abstract: It is seen that rescue operations often will be delayed and misguided due to shortcomings in the communication and coordination between concerned security units. This paper indicates means of improving necessary learning and reflection on communication patterns in interregional security and rescue work. A system, the NetAgora Learning System (NLS), is designed and prototyped for this purpose.

Keywords: Communication patterns, security work, reflection, learning

Acknowledgement: The research is founded by the EU Interreg Sverige-Norge IIIA.

1 Introduction

Purposeful cooperation between security units and focused preparations are factors of paramount importance for a effective rescue operations and disaster handling in a region. However, from real world observations, as well as simulation results, it is seen that rescue operations often will be delayed and misguided due to shortcomings in the communication and coordination between concerned security units. Those mistakes will be extra aggregated if the region in focus is cut by a national border. In this case differences in responsibilities, organisation, and working procedures are example of factors further obstructing the necessary communication between the security units in charge.

Putting all this together, the purpose of this paper will be to indicate means of improving necessary learning and reflection on communication patterns in interregional security and rescue work. In order to obtain that objective the NetAgora Learning System (NLS) is designed and prototyped. NLS fits into our NetAgora Environment and is swiftly and easily accessible on the web.

A mountainous and sparsely populated region, parted between Sweden and Norway, serves as test case for this research. This paper will put a special focus on initial verifications of the first implementation of NLS.

2 The NetAgora Framework

NetAgora is computer and net based integrated environment for mutual preparation and training. Its core contains a disaster simulator, a scenario editor, and an assessment kit. NLS was not part of the first version of netAgora but was later identified as a fourth component of crucial importance. A Virtual Situation Room serves as a common interaction surface toward the users. Through this surface the users have access to all the resources of netAgora, freely adopted to meet the specific requirements of different user categories and individual users.

3 Theory Base Supporting the NLS Initiative

Well known theories about double loop learning and reflection in action forms the theoretical justification of NLS. Double loop learning implies questioning the underlying policies and objectives, i.e. are we learning the right things. Hence, this type of learning includes reflections of your own learning process. Further, the professional practitioners sometimes address questions like “How am I framing the problem that I am trying to solve? What are the criteria by which I make this judgement?” Through questions like that the practitioner may get new insights or even criticize the initial understanding. In short, continuous double loop learning at the work place plays a crucial role in building necessary preparedness and adaption to new and unknown circumstances.

However, from our empirical case studies we have seen that that informal work place learning needs to be stimulated and reinforced. Hence, drawing on this research, NLS is designed in order to provide the professional practitioner, in this case security officers involved in regional risk and crisis management, with best possible support in their ongoing learning and reflection. In this respect NLS can be seen as a vehicle for computer improved Organizational Intelligence.

4 The NLS Design

Drawing on the identified theory base, the NLS design is grounded on three basic assumptions:

1. Increased knowledge of the available regional rescue resources will lead to increased effectiveness in the rescue operations.
2. The personal communication pattern will give a picture of the person's knowledge of the regional rescue resources.
3. By continuously reflect on the personal communication pattern knowledge and effectiveness can gradually improve.

NLS can be used in recording or reflection mode. In recording mode the communication pattern of the user is recorded in a data base. This is done by the user answering seven simple questions. This can be done at several occasions in order to indicate changes over time. In reflection mode sociomapping techniques are used for giving a visual accounting of the communication pattern.

Hence, NLS will give the users a chance to reflect upon their communication behaviour and communication patterns. Further, they can reflect upon the changes over time or on own communication pattern in comparison with those of different sub groups of security officers in the region.

5 Initial Experiences of Using NLS

NLS has been implemented as a first prototype. Its use in the test region indicates that it is a helpful tool to use when exploring the communication patterns. We have used the NLS in individual interviews and have found that it is easy to grasp the complexity of gathering the individual’s communication network and the qualitative and quantitative aspects of it. The resulting graphs can then be used for reflection both for the individuals and for smaller or larger groups.

6 Closing Remarks

The NLS system discussed in this paper is still in development. The initial tests that have been performed, however, shows that the use of the system leads to many questions and reflections. Hence, in that respect NLS has a promising potential in interregional security work.

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Process models for disaster management: standardization and assessment

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Abstract: The increase of natural and man-made disasters world wide underlines the need for further improvement of Disaster Management in terms of preparation, prevention, and acute response. International organizations like EU, ISO, IFRC, INSARAG, UN OCHA, etc. aim at improving cooperation and coordination in case of large scale disasters so as to provide for fast and efficient responses to disasters. From a systems point of view a disaster response can be viewed as an external compensation system which aims at reducing/eliminating the undesirable effects of disaster.

The process view and process models describing the necessary best processes and practices have proved to be very successful in industry. They could also - mutandis mutatis - be applied to Disaster Management. In this paper we describe the basics of process modeling and the necessary adaption for use in Disaster Management.

Keywords: Disaster, Intervention, First Responder, Disaster Management, best practice, systems view, process view, process model, process engine,instantiation, capability, assessment, disaster response, intervention, human factors, resilience

Acknowledgement: This work is partially based on work performed during 2009-2011 in the project "KIRAS PL3:SimRad.COMP: Simulations- und Informationssystem zum Administrieren von Hilfseinheiten bei Katastrophen...", KIRAS-Project no. 818784 of the Austrian Federal Ministry for Transport, Innovation and Technology (BMVIT).

1 Interventions in Disaster Situations

The increasing occurrence of natural and man-made disasters world wide underlines the need for further improvement of Disaster Management in terms of preparation, prevention, and acute response. Observing the increasing global impact of disasters, the European Union aims at further improving cooperation and coordination so as to strengthen preparedness and therefore provide for a fast and efficient response when disaster strikes (see European Commission - MEMO/13/1120, 10/12/2013). From a systems point of view a disaster and the corresponding intervention can be viewed as two systems (fig. 1): a failing system which due to the disaster loses its reliability and consequently an external compensation system (the First Responders) which aims at reducing/eliminating the undesirable effects of disaster and returning the failing system back to a reliable state, which is not necessarily the original one (Chroust, 2012). In order to be effective the compensation system must possess sufficient Requisite Variety (Ashby, 1958) even taking into account that a failing system changes dramatically over time. Due to their problem solving capability human play an essential role as First Responders in compensation systems.

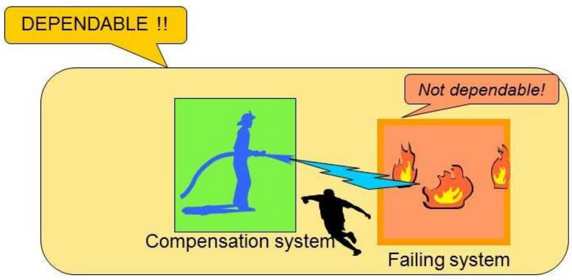

Fig. 1: System with compensation system

2 The need of a process view

Global coordination and cooperation of Disaster Management as postulated by the EU is only possible by analyzing and codifying the processes needed for an intervention. Typically ISO, the International Standards Organisation, has started to provide a framework for describing and analyzing disaster management processes via the new standard ISO22320 (Lazarte, 2013; ISO, 2011a,b). The ISO 22300-family of standards outlines global best practices of establishing the organizational side of command and control structures and procedures, decision support, traceability and information management. Similarly the International Federation of Red Cross and Red Crescent Societies (IFRC) have published several guides to the same topic (IFRC (ed.), 2007b,a). Also the International Search and Rescue Advisory Group (INSARAG) and UN OCHA (INSARAG (ed.), 2012) have their guidelines for interoperable interventions and action planning. Each First Responder Organization, which is active in an international environment has to comply with these guidelines for international cooperation. Also national organizations have handbooks for emergency processes and alarm structures. These tools are essential for all types of organizations for increasing their capabilities for coping with crisis and responding to disasters.

Process models describing the necessary best practices and their interdependencies have proved to be very successful in industry, e.g. ISO 15288 (Chroust, 1996; Curtis et al., 1992; ISO/IEC, 2006). They could also - mutandis mutatis - be applied to Disaster Management (see section 4). Similarly the Service Management view, e.g. as discussed in ISO 20000 (Katzan, 2008; Clifford, 2011) also stresses the process view.

3 The Process-Model Concept

A process model (e.g. ISO 15288 (ISO/IEC, 2006)) describes in an abstract form all necessary activities (e.g. 'evaluate damage' or 'send intervention team') and their logical dependencies (e.g. 'evaluate damage' before 'sending intervention team') and the necessary work products (e.g. 'damage report', 'list of victims') to be produced and used during these activities.
Whilst modelling the process semantically equivalent activities are abstracted into one "activity type". Similarly the work products are abstracted into "work product types", see fig. 2 and fig. 3.

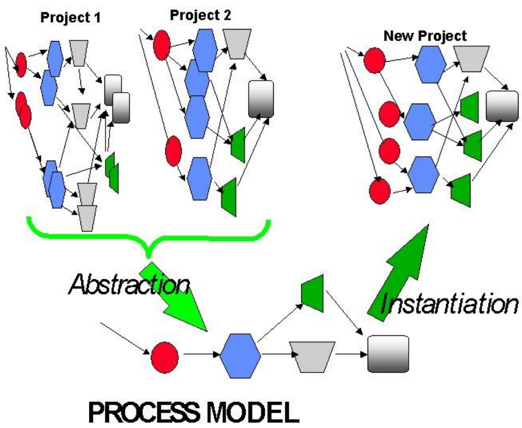

Fig. 2: Process Abstraction and Instantiation

This approach is closely related to the class concept in object oriented programming. A process model contains in abstracted form the experiences of many preceding processes combined with theoretical considerations and desirable improvements. It abstracts from idiosyncrasies of a single process and describes the process 'in general'. The granularity ('the size') of both activity types and work product types must be carefully chosen: not too big, in order to describe the necessary activities in detail and not too detailed in order to still be applicable over a wide range of applications. The logical dependencies between activities are also expressed on the 'type'-level and have to be applied for the individual activity instances (which also leaves considerable freedom to "navigate" the process (Chroust, 1994)).
When performing an actual process the activities and work products are 'instantiated', i.e. they are 'replicated' as often as necessary (fig. 3).

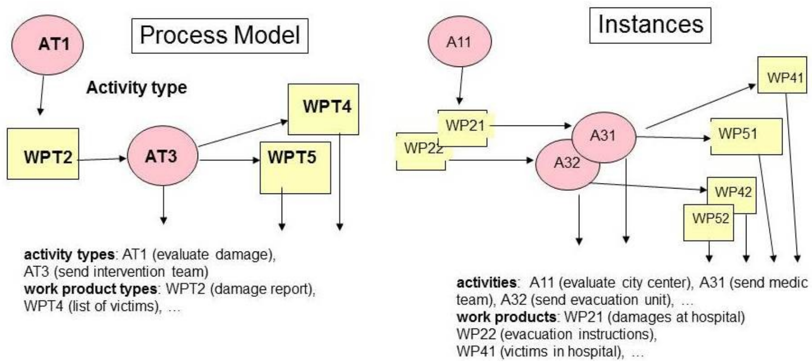

Fig.3: Fundamentals of process modeling: Model and Instances

Some of the key advantages of the definition of a formal process model are:

- The process can be recorded, standardized, transmitted to others, stored and taught. Its effect is to convert implicit to explicit knowledge (Nonaka and Takeuchi, 1995).
- It acts as a repository for old and new best practices, thus preserving experience.
- It can be evaluated, improved, its capability assessed (van Loon, 2004; ISO/IEC, 2002, 2012) and compared with others.
- It provides standardization across different persons and activities.
- The enactment of a formally described process model can be supported by a process interpreter ('process engine', fig. 4) which guides the user through the process activities under consideration of the logical dependencies ('navigation'), supports the storing and retrieval of work products, identifies (and sometimes even activates) tools.

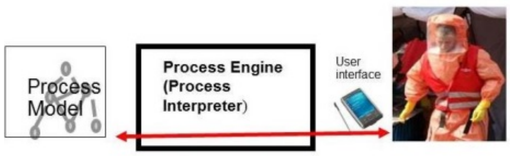

Fig. 4: Supporting a First Responder by a Process Model and a Process Engine

4 Differences between systems engineering and disaster management

The introduction of process models has been very successful in the production industry (Humphrey, 1989). Its application to Disaster Management holds the chance for further improvements, but needs considerable changes:

- Disaster Management requires urgent action of different sorts, depending on the type, the extent of the disaster and the affected environment. Therefore the process model must provide sufficient alternatives, being both highly flexible and adaptable. Especially navigation must be extremely flexible and allow for ad-hoc changes to the process model (computer support can be very helpful here!)

- Due to considerable amounts of stress, anxiety, and uncertainty on the scene of a disaster the process model must be expressed in understandable terms and must be largely intuitive and self-explanatory. One must also consider that many of the stakeholders will not be accustomed to the use of process models, especially those without professional training (typically volunteers).
- All activities must be designed with strong consideration of human factors with respect to all involved persons (McEntire, 2007; ISO, 2011a). This includes observation of cultural differences between ethnic groups (McEntire, 2007) with respect to contents, form and differences as far as belief of and interpretation of warnings and instructions and the willingness to obey them (Haddow and Haddow, 2008) is concerned.
- Disasters damage the infrastructure and the environment, i.e. some of the needed personnel, material goods and communication means are not available (Haddow and Haddow, 2008). Substitute materials and replacement personnel are necessary. Gaps in communication (Chroust, 2008) must be bridged by involving different communication channels (voice, signaling, graphic, etc.).
- A considerable part of the total process must be accomplished in the 'Preparation Phase', i.e. before disaster actually strikes. All conceivable alternatives must be prepared for (Tierney et al., 2001).

5 Summary

Defined and widely accepted process models for Disaster Management are cost-effective, reliable, consistent and efficient tools in helping to improve Disaster Management, although considerable adaptions are needed with respect to the contents of the Process Models :

- They must be extremely flexible and provide many different alternatives.
- They must be highly modular, allowing the combination of different submodels, e.g. depending on the type of disaster, severity, geographic situation, etc. (McEntire, 2007)
- They have to display robustness, resilience, and hopefully antifragility (Taleb, 2012).

With respect to the representation of the Process Model :

- Process Model must be easily and largely intuitively understood by involved stake-holders (both professional assistance personnel and volunteers (Tierney et al., 2001)) in order to be followed and enacted correctly (McEntire, 2007).
- Process Models must be able to be communicated in different forms (written, graphically, acoustically, ...), even in the presence of stressors (danger, anxiety, ..) and adverse environmental factors (low visibility, noise, heat, bad visibility, physical impediments, ...) (Chroust, 2008; Haddow and Haddow, 2008).

In short, process models have proven their usability and effectiveness in many domains and would, after implementing the necessary modification and addition, also be a very useful support tool in Disaster Management.

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Resilience and graceful degradation in cooperation networks. Experiments with simulated Public Goods games

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Keywords: Public goods, cooperation, resilience

Game-theoretic experiments suggest that due to social contagion an initially high probability of cooperation in repeated Public Goods Games (RPGG) can be lost if the negative influence of free riders is taking effect (Fehr/Gächter 2000). Inducing a downward spiral, the free riding of some diminishes the contribution-probability of others and eventually destroys the public good. Contagion however, might unfold in the other direction as well. Unprofitable experiences and dissatisfaction with overall non-cooperation can alter cooperation strategies and revert the decrease of contribution-probabilities. The negative experience of nobody gaining because nobody is contributing might reinvigorate cooperation.

This process might be pictured as the behavior of a ball on a rugged surface with valleys and peaks (Fig. 1). Initially, this ball is placed on a random point that corresponds to a tentative first round of the public goods game with most players investing but some deciding to free ride. When repeating the game, due to its contagiousness the probability of free riding increases. The ball on the surface follows gravity and rolls to a valley, a local minimum that marks overall zero-investment. Nobody gains from investing as long as nobody else invests. The ball stays put in the valley. This minimum, however, is suboptimal and everybody knows it. If investment would rise, so would profit. Therefore participants might start tentative investments, which when reciprocated eventually could drive the ball beyond the crest to a second minimum on the surface which marks a more efficient outcome. Between the global and the local minimum a mound of unstable investments constellations delimits overall defection from cooperation.

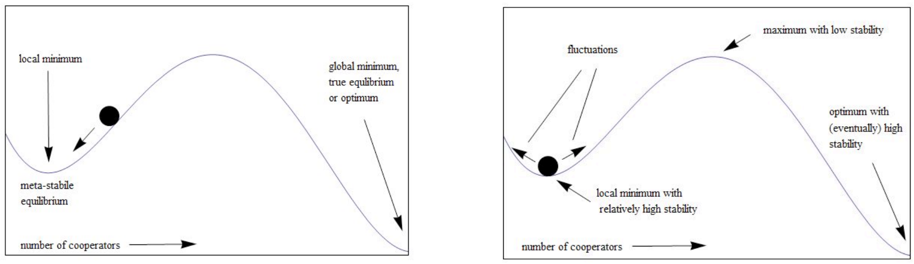

Figure 1: Dynamics of the repeated common-good-game, pictured as a ball on a surface with two equilibrium solutions (minima) separated by a mountain (a maximum) of unstable investment constellations. Since the solution to the social dilemma at the local minimum is suboptimal, there might be fluctuations in the position of the ball (right image) which eventually can become large enough to push the ball over the maximum on to the global minimum marking the optimal solution.

We suggest to regard the crest of this mound as a sort of “event horizon” for cooperation and the steepness of its slopes as indicators on the one side for resilience and on the other side for how graceful cooperation degrades once it is lost. We illustrate this suggestion by way of a simulated RPGG in which players are positioned in various network topologies showing different predispositions either to foster the emergence of cooperation or to remain stable once players are (artificially) deprived of their experiences (Füllsack 2014). Subsequently, exposing these networks to a steady stream of normally distributed perturbations provides information about the resilience, respectively graceful degradation that these networks impart to cooperation. We believe that this information can serve to organize systems in a way that mitigates the chance of disruptions.

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Overmind territorial resilience

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Abstract: The subject is a high tech solution on the basis of a systemic simulation model that helps to anticipate, to prevent and to resist accidents and major disasters of all kinds with the least damaging impact on social life and supports recovering and adapting after disaster. We use systemic approach to support management of disasters before, during and after the crisis. We see our solution as "solution-in-progress" and as an integrative system for successful approaches to management of complexity.

We are working on complementing our solution with compatible concepts from area of soft and fuzzy system methodologies and cybernetics.

Keywords: resilience, disaster, crisis, systemic probabilities, System Dynamics, interdisciplinary, maps, GIS, sub disciplines, system principles, system types, system classes, systems thinking.

To cite this document: Gilles Legrand, CEO of Overmind. www.overmind-dynamic.com

1 Before the crisis

1.1. Diagnosis of systemic risks

We are using systemic approach to anticipate environmental complexity and interdependencies between psychological, social, technological and natural factors in order to detect vulnerabilities and deficiencies in existing structures, to improve resilience and provide forecasting of possible disasters. System dynamics modeling & simulation help to identify systemic risks and their effects, including cascading and feedback effects, unfolding in time.

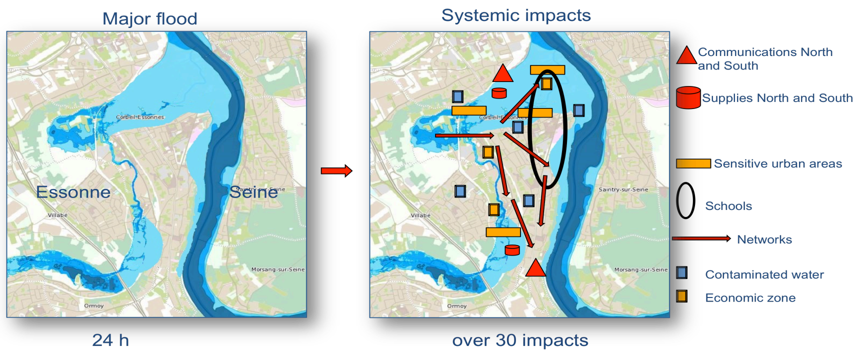

Figure 1: Major flood anticipation (Overmind, 2014)

- Severity of events after 24 hours for the entire city

We integrate the data that covers the whole territory and also its defined parts to analyze impacts, for example, neighborhood for neighborhood.

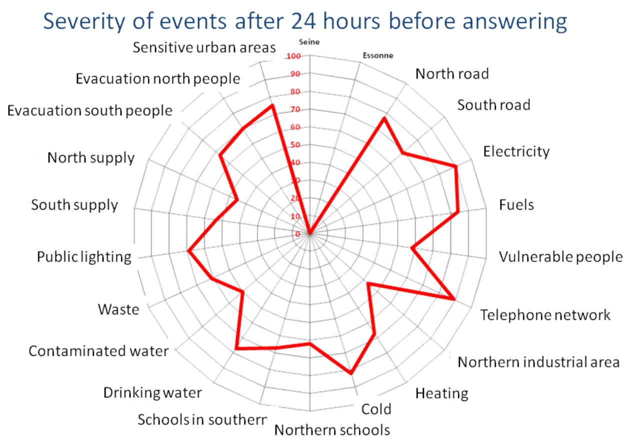

Figure 2: over 30 Impacts on the city (Overmind, 2014)

- Severity of events after 24 hours for a neighborhood

Figure 3: over 30 Impacts in downtown (Overmind, 2014)

- Financial, social, economical, organizational and structural stress

Our research indicates that it is preferable to use simple indicators for better understanding by all stakeholders.

Financial stress is a combination of costs arising from the crisis.

Economical stress is a combination of impacts on economic zone

Social stress is a combination of impacts on population

And others

1.2. Diagnosis of resilience

Using systemic simulation model we can anticipate impacts and ripple effects of policies concerning prevention, response and recovery & reconstruction and detect the best timing, combination and sequence of policies to assure resilience and to optimize resource allocation.

1.3. Training simulator

On the basis of a systemic model we build a complete training simulator for all relevant stakeholders with scenarios that allow simulation of different policies, structural improvements, events and hazard environments.

Figure 4: two interfaces of the cockpit of the crisis simulator (Overmind, 2014)

2 During the crisis

We assure PC support during the crisis through modifying systemic models in real-time in accordance with status information. Our solution is able to recalculate the systemic effects and thus anticipate damages to come. For example we can tell firefighters if there will be more water in the pipes of the district where they will go.

Dynamic anticipation of interdependencies support decision making for better allocation of scarce resources for the resolution of the crisis.

Figure 5: command post crisis Overmind is connected in real time command post crisis city (Overmind, 2014)

3 After the crisis

Post crisis assessment is important for improvement of the existing policies and structures to assure resilience for the future - the systemic model evolves through integrating of lessons learned.

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The RE-ACTA crowdtasking platform: for crisis and disaster management in Austria

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Abstract: In 2012, the international Red Cross declared an urgent need to strengthen the population's resilience regarding the most important challenges in today's crisis and disaster management. This is also evident for Austria when looking at recent occurrences of flooding in 2013. That mentioned, in the light of resilience, to be preventive and prepared, the Austrian crisis and disaster management heavily relies on a large volunteer community. While organized volunteers are educated and are contributing to the activities of the Red Cross on a regular basis, the idea of crowd tasking is addressing those spontaneous volunteers, who are not bound closely to the organization but are willing to contribute spontaneously, when their neighborhood is affected directly by a crisis situation.

Keywords: Crowdsourcing, Crowdtasking, Crowdtasking Tool, New Media, Social Media, Volunteer Management, Decision Support System, Crisis and Disaster Management, Humanitarian Non-Governmental Organizations

1 The challenge

One of the major challenges is the process of systematically tasking-the-crowd, and crowdtasking means to have spontaneous volunteers involved in the most effective way during or after an emergency situation. This also implies that such a community must be built up and maintained before the crisis situation[1]. New ways need to be found for loosely binding volunteers to their organization and organizing them effectively as part of Austria's crisis and disaster management strategy in Austria. This short paper briefly discusses some of the advances of the Project RE-ACTA (Resilience Enhancement by Advanced Communication for Team Austria)[2] in the light of Crisis and Disaster Management, and some of its concepts involved. It also dwells on the newly emerging concept of crowdtasking and its current advances.

2 The project

The National Austrian Research Project RE-ACTA[3], which has started in November 2013, addresses the challenge of crowd tasking. It develops and tests new processes and workflows for volunteer communication and coordination by utilizing mobile devices (e.g. smartphones). New crowd tasking processes are defined in cooperation with and validated by the Austrian Red Cross and Team Austria[4]**.** The process design incorporates all necessary user requirements as well as the applicability of a crowd tasking tool in terms of legal aspects with special emphasis on liability and privacy. Another important point covered is the aspect of the acceptance of the tool and how the user community approves the new appliance[5].

New and social media play an increasing and vital role by providing opportunities to integrate the population in the process of crisis accomplishment. Many researchers are today focusing on the utilization of the social media as information sources for better situation awareness. And indeed, improved methods and applications for monitoring Social Media can provide valuable information about incidents in the field[6]. Crowdtasking is different in two aspects: (a) not the entire crowd (i.e., all people somehow involved into the crisis situation) is addressed but a sub-set of a community of loosely-coupled pre-registered volunteers; (b) this community is not only regarded as (compared to the entire crowd more reliable) information source, but also as possible actor in the field.

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1 Austrian Federal Ministry of Labor, Social Affairs and Consumer Protection (ed.) (2009): Volunteering in Austria. 1st Report on Volunteering, Vienna 2009 (summary available), (in German).

2 RE-ACTA Webpage: http://www.reacta.at/

3 Project description FFG: http://www.kiras.at/gefoerderte-projekte/detail/projekt/re-acta/

4 Red Cross Webpage for the Austrian Red Cross – Team Austria: http://apps.teamoesterreich.at/

5 Christensen, C. G. (2013). Social Media Volunteering Application. Retrieved from http://www2.imm.dtu.dk/pubdb/views/edoc_download.php/6558/pdf/imm6558.pdf

6 Meier, P. (2011): Do "Liberation Technologies" change the Balance of Power between repressive States and Civil Society. (Dissertation). http://irevolution.files.wordpress.com/2011/11/meier-dissertation-final.pdf

RE-ACTA therefore comprises a number of basic processes and dedicated tools for supporting this processes:

- Continuous process: community building, registration of volunteers and data maintenance
- Launching of a crowd tasking: definition of the task, selection of the volunteers to be addressed and communication of the task to these volunteers.
- Crowd task execution: Execution of the task by the addressed volunteers, gathering of the reports from the volunteers and provision of “compensation” (a little bit more than just a warm “thank you”, e.g. access to specific information, special guidance, and so on).
- Analysis and visualization: analysis of the reports and visualization of a meaningful situation picture.
- Reporting: production of reports, which can be utilized within the Crisis & Disaster Management effort in order to improve situation awareness.

It is evident, that these processes can and shall be supported by information technology. Within the project, the following IT-tools are considered:

- Web portal for volunteers in order to support the continuous process
- A mobile application (“RE-ACTA Volunteers App”) for smart phones in order to support the information, guidance and reporting for each volunteer while executing a crowd task
- An analytic engine for supporting analysis of the volunteer’s reports. This analytic engine may additionally be capable of deriving information from Social Media
- A visualization and reporting tool for the production of meaningful situation reports

Some critical questions for the success of the crowd tasking concept have already been known at the beginning of the project, such as: how to ensure the quality of data in terms of relevance and credibility; how to motivate people, build up the community and keep it alive during “peacetime”; how to integrate the crowdtasking processes into the entire crisis- and disaster management processes and the SOP’s (Standard Operating Procedures) of the involved actors; how to comply with legal preconditions in terms of privacy and liability.

Therefore, the RE-ACTA project focuses within its first phase on the methodological approach to gather and analyze information from all kind of sources (i.e. literature review, social media, volunteers, expert panel, etc). The results lay the foundations for further work on how to improve and technically support the crisis- or disaster-related processes of crowd tasking e.g. within the Team Austria platform.

The literature review included an extensive list of tools that were mentioned in the context of crises and disaster management in general. The list included applications, blogs and microblog services, collaborative knowledge sharing services, communication services, content management tools, content sharing tools, digital volunteer platforms, person search services, social networking tools and so on. The list also included and identified hardware for crises or disasters, theoretical models and frameworks, related projects and best practices in terms of guidelines in the context of crises and disasters. In addition, the expert panel (i.e. focus group) evaluation carried out with experts by the Austrian Red Cross, added invaluable insight and knowledge to the most relevant tools and good practices in place or required. The knowledge gained shall be utilized for the extension of the Team Austria platform by adding a crowdsourcing and crowdtasking space (Neubauer, G. et al., 2013). Some of the main results of the focus group include an in-depth understanding of the processes already established or still in a state of flux, the naming of the single tasks and steps in the workflow, the formal and informal ways of communication and organization in case of crisis and disasters, the stakeholders and their responsibilities and the different views to the same processes by participants, and new ways of crowdtasking.

According to Neubauer et al., (2013), crowdsourcing supports the speedy acquisition of a wide range of data to obtain a rough picture of a situation, such as a crisis scenario.

Crowdtasking, in comparison, contributes to an enriched and more reliable picture of defined and measurable parameters of a disaster. Thus both, the more open crowdsourcing as well as the more structured crowdtasking are supplementary concepts" (Neubauer et al., 2013). All the above mentioned processes and tasks would be technically supported and addressed by Ubicity, a new tool for data-driven applications based on the ideas of ENVIROFI together with the Frequentis Control Centre Solution. The tool is capable of analyzing large amounts of unstructured and semi-structured geographic and temporal referenced data from multiple domains in near real time. The additional information, which is not available in conventional crisis management solutions shall allow help to optimize the crowd tasking processes solutions in all the phases of the disaster-management cycle, not only in the emergency phase but also during prevention and preparedness to assess the wider effects of the crisis management activities in the near real time (Havlik et al., 2013).

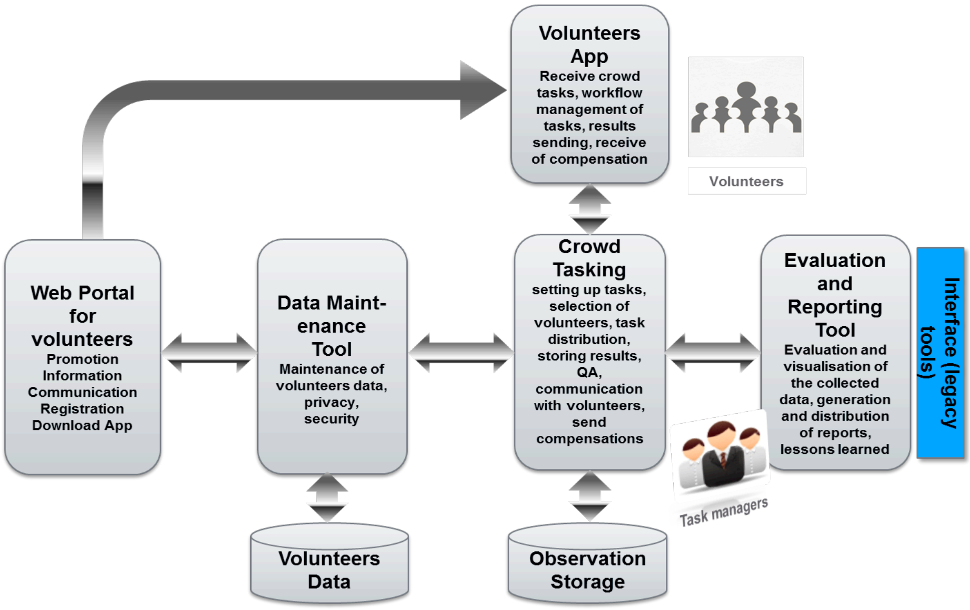

Figure 1: Functional blocks of a crowdtasking tool (Neubauer et al., 2013))

3 Conclusion

Due to reoccurring crises and disastrous events, such as floods, a sharpened awareness about possible consequences has occurred. This calls for a growing need to foster a more robust, and interdisciplinary approach not only to understand, but also to systematically mitigate their effects. Especially the resilience of the society and the ability of the citizens themselves to respond to and cope with natural disasters shall be increased. The aim is to develop and implement a newly designed process for crowdtasking, on the basis of the method known as "Concept Development & Experimentation" (CD&E) (Figure 1) and to foster the resilience of the public while at the same time relieving emergency and humanitarian organizations from an uncoordinated influx of information or uncoordinated spontaneous volunteers (Crowley, J. and Chan, J., 2011). The RE-ACTA approach and its software developed will help to co-ordinate activities of pre-registered, loosely coupled spontaneous volunteers and to obtain a large amount of structured information from them, enriching the knowledge about the situation in the field.

Acknowledgement:

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1. AIT Austrian Institute of Technology GmbH
2. Frequentis AG
3. INSET Research & Advisory
4. Vienna University of Technology
5. Austrian Red Cross

Credits of the work go to entire RE-ACTA Research Team.

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I A 2
Economic system change: contributions to an inclusive and sustainable society

Chairs

Silvia Zweifel, Economía Amable group, Grupo de Estudio de Sistemas Integrados, GESI
Manfred Blachfellner, Change the Game Initiative, and International Controller Association's "Ideenwerkstatt", and Economy for the Common Good Association, Austria

How to co-create desirable futures is the key issue of this meeting/workshop. Its purpose is to foster a renewal of concepts and practices in every field of activity. A future scenario depicted in an essay of Silvia Zweifel will be used as a meta-space to engage in prospective imagination & spirited conversation. Some particularities of that desirable world will probably reflect participants' current situation. Under that light each one will be encouraged to share his/her ideas and experiences. This will be a gathering to refresh creativity and enthusiasm, vitalizing a collaborative network, and perhaps engaging in joint projects. To join the event, a vocation for conviviality, inclusive, thrivable world is recommended. Please come in comfortable clothing to be able to enjoy and move freely.

List of Contributors

Manfred Blachfellner: Evolutionary change of economic system: an example of reality
Eugenio Correa: The economy science as a technic into the Heideggerian conception
Tuan Ha, Ockie Bosch, Nam Nguyen: Applying an Evolutionary Learning Laboratory approach for improving the quality of life for women smallholder farmers in the Red River Delta of Vietnam
Dana Klisanin: Changing Global Mindsets: Convergence & Activism
Helmut Loeckenhoff: World whereto? A transdisciplinary view to guide change
Andre Martinuzzi, Michal Sedlacko, Jill Jaeger: Knowledge brokerage for a sustainable Europe: a systems thinking approach for increasing the impacts of research and promoting evidence based policy making
Erika Quendler: Needs, quality of life and sustainable development: an inclusive development concept
Ricardo Rodriguez-Ulloa, Jose Fiestas-Patiño, Laren Osorio-Toribio, Andrea Tirado-Dueñas: An education for a sustainable and inclusive world: a soft system dynamics intervention in Peru
Elisabeth Schauppenlehner-Kloyber: Shaping future together: transdisciplinary collaboration for sustainable urban planning

Silvia Zweifel, Mechthild Adameit: A multidimensional “economia amable” co-creating desirable futures

Silvia Zweifel, Mechthild Adameit: “Desirable Futures Gathering”, “The world of Navis Utopia” as a meta-space – Workshop – No Abstract

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Evolutionary change of economic system – an example of reality

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Abstract: While the current economic model in some cases creates prosperity, it also creates a number of serious problems: unemployment, inequality, poverty, exclusion, hunger, environmental degradation, and climate change. Social and ecological crises are accompanied by three fundamental cultural crises: an existential crisis of purpose in life, a crisis of values and a crisis of democracy. According to a poll by the Bertelsmann Foundation in the summer of 2010, which was repeated in 2012, 80 to 90% of Germans and Austrians want a "new economic order". The international movement "Economy for the Common Good (ECG)" started in October 2010 on the initiative of a dozen companies in Austria with just that objective in mind: the economy has to be brought in line with constitutional values and objectives, with the values of relationship building and sustainability. To this end, they developed a "Common Good Balance Sheet" which they implemented for the first time in 2011. In concrete terms, this balance gives an account of the degree to which the company fulfills the five most important constitutional values of democratic states: human dignity, solidarity, sustainability, justice and democracy in relation with the stakeholders supply er, financiers, staff, customer and society. The goal is to achieve continuous development in small steps.

In 2012 also in Tyrol a local-group founded the regional "energy-field". This report will show the development of collective learning, cooperation, examples of really change and peer-evaluation, further the ongoing contribution for the continued improvement of the indicators and their valuation.

Keywords: economic model; Economy for the Common Good; constitutional values; relationship; sustainability; human dignity; solidarity; justice; democracy; collective learning; cooperation; peer-evaluation; indicators; valuation

Acknowledgement: The author accompany the entrepreneurs in the process of Common Balancing and is Member of the Balance-Matrix development-team for the ECG-Association.

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Manfred Blachfellner

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The economy science as a technic into the Heideggerian conception

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Abstract: There is an interest in meditating about the fundamentals of the leading economic paradigm today, which is characterized by an extreme individualistic vision, in order to make an attempt to extract conclusions that would be necessary in the perspective of a possible turn to a more solidary and sustainable economy. In this respect it becomes unavoidable to pay attention to the conception of the humane vis-à-vis of the attempts of objectifying its nature in terms of an ideology of consumption and production.

Keywords: economy; education; ethics; sustainability;

Meditating about the fundamentals

There is an interest in meditating about the fundamentals of the leading economic paradigm today, which is characterized by an extreme individualistic vision, in order to make an attempt to extract conclusions that would be necessary in the perspective of a possible turn to a more solidary and sustainable economy.

1. First, the consequences that has brought about to society the introduction of an economic system based on individualism, and that aspires growth and consumerism as its stimulus system will be presented.

2. The philosophic foundations of the technic as a tendency of the present epoch and its consequences, in particular what makes reference to the economy and the invasive character of its logic in all aspects of human endeavour, such as the techno-economical criteria for the administration and delivery of health, education and culture will be analyzed.

3. The role that the "objective time" in a mode of allienation, where human values are reduced to the condition of a productive resource will be described.

4. The intuition of a new subjectivity which is non-individualistic, that could derive in a change in the conception of the economy, which would be in-line with the more authentic development of human nature, as well as its possibilities, will be described.

This basal reflexion, that will be fundamental reference of this proposal, is based on the philosophical legacy of the XX Century contributed mainly by existensialism, phenomenology and post-structuralism in order to conceive human nature from the internal experience of an epoch marked by the "empire" of technical thinking.
In this respect it becomes unavoidable to pay attention to the conception of the humane vis-à-vis of the attempts of objectifying its nature in terms of an ideology of consumption and production.

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Applying an Evolutionary Learning Laboratory approach for improving the quality of life for women smallholder farmers in the Red River Delta of Vietnam

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Abstract:

This study employs a systems thinking approach through the Evolutionary Learning Laboratory (ELLab) framework (Bosch *et al.*, 2013a) to identify the most economically, environmentally, culturally and socially appropriate solutions for improving the quality of life for women smallholder farmers in rural Haiphong (Northern Vietnam). Special emphasis is given to the perceived (visible) problem of labour constraints. Implementation of the first five steps of the ELLab revealed that income, production efficiency and health are the main contributing factors for improving the quality of life for the women farmers. The leverage points for systemic interventions were defined and an initial integrated management plan was formulated. This will be refined further and validated in the next steps before developing actual context-based implementation plans at the localities to address the “real needs” of the target group and related stakeholders. The outcomes and lessons learned from this research will be shared with other case studies via the Global Evolutionary Learning Laboratory (GELL) for an advanced level of co-learning and management performance.

Keywords: Evolutionary Learning Laboratory (ELLab), quality of rural life, women smallholder farmers, labour saving, systems thinking, systemic interventions, rural income.

Acknowledgement:

The authors would like to express the great gratitude to the Bill & Melinda Gates Foundation and the University of Adelaide for providing funding to make this research possible. We are very grateful to Haiphong People's Committee, Department of Agriculture & Rural Development, the Extension Centre, Department of Planning & Investment, Department of Statistics and the district extension network for their continuous cooperation and supports. Our special thanks go to all the women participants of Kien Thuy, Vinh Bao, An Lao, and Tien Lang districts for their time and contribution to this research.

In search of labour saving strategies and innovations for women smallholder farmers as outlined in the Gates Foundation funded Grand Challenge Exploration (Round 10, 2013), this study applies the systems-based Evolutionary Learning Laboratory (ELLab) approach of (Bosch *et al.*, 2013a). Appropriate systemic intervention strategies with a special focus on labour saving initiatives in rural Haiphong were formulated.

The first fieldtrip was conducted from September to October 2013.A series of dialogues, workshops and focus group discussions were held with women farmers in four rural districts and representatives of all relevant stakeholders, including all sub-departments of the Department of Agriculture and Rural Development (DARD) and service providers. The first five steps of the seven-step ELLab framework (Bosch *et al.*, 2013a) were applied to identify the core insights and “real problems” that the women in small-scale agriculture have to face.

The fundamental philosophy of the ELLab framework (Figure 1) lies in its systems thinking and participatory approaches which enable all participants to identify the “root causes” via collaborative learning, decision making and actions. Divergent viewpoints (mental models) of different stakeholders were gathered, shared and integrated throughout the process to analyze the whole system and associated issues from a systems perspective. By comparing the ELLab with other frameworks such as action research (Coughlan & Coghlan, 2002) and adaptive management (Bosch *et al.*, 2004), the ELLab framework is clearly a more superior framework. This is due to the incorporation of systems tools to help define leverage points, systemic interventions (solutions) and the fact that these interventions can be tested before actual implementation. Through the joint learning process, the mental models (mindsets) of individual stakeholders are shared and transformed from narrow personal experience-based thinking into one that is more comprehensive, open and reflective to induce more factual and justifiable beliefs and opinions, leading to appropriate actions. Furthermore, the approach places strong emphases on “true participation”, capacity building and empowerment for participants through a simple guided ELLab process to create a sense of ownership, accountability and thereby long lasting outcomes.

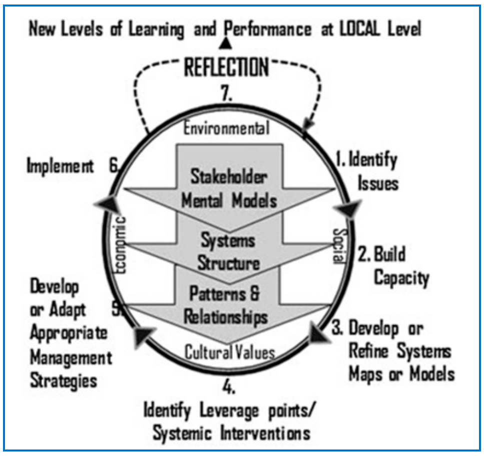

Figure 1. Evolutionary Learning Laboratory for Managing Complex Issues (Bosch *et al.*, 2013a).

Interesting findings were obtained from our initial study. The perceived visible labour hardship was found not to be the single-most important “root cause” of the difficulties of the rural women in Haiphong; low income, manual labour hardship and poor health were found to be interrelated and in all cases contribute together to the quality of their lives. Thus, improving income, production efficiency for reduced workload and health were seen as the desired outcomes for enhancing the quality of life for the target group in particular, as well as the bigger system they are part of (rural households and communities in general).

The results of the first three ELLab steps are indicated in Figure 2, in which the key variables were defined in an interrelationship manner. With the use of Vensim software (Ventana®, 2011), the selected participants together with the facilitators (research team) developed an initial system structure (causal loop diagram) based on the diverse “mental model” inputs from the workshops, dialogues and discussions. The key leverage points (indicated in red) were identified for the analyses of intervention strategies.

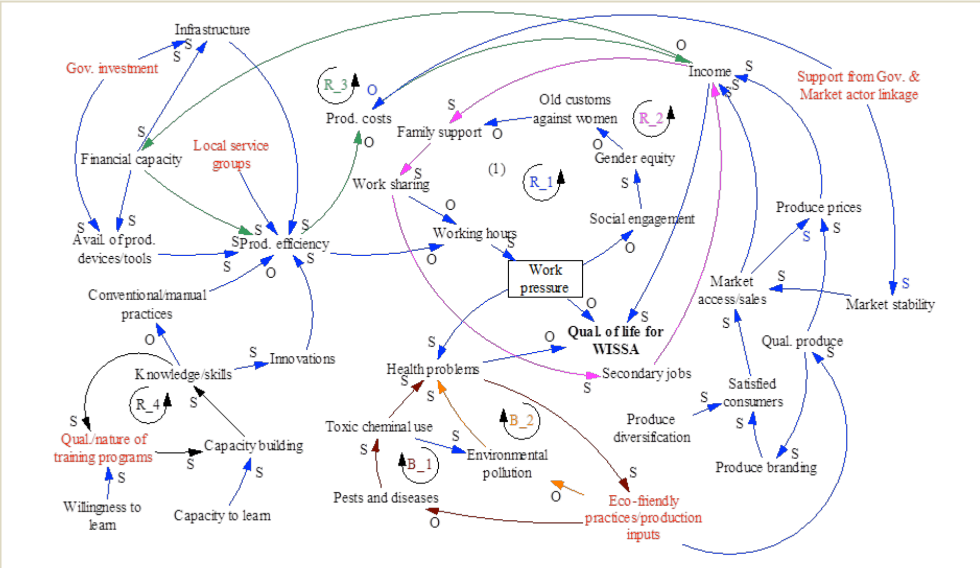

Figure 2. Causal loop diagram on improving quality of life for women smallholders in rural Haiphong. Red coloured variables represent the main leverage points. Legend: S - same direction; O - opposite direction; R - reinforcing (loop); B – Balancing (loop).

Bayesian Belief Network (BBN) modeling (Cain *et al.*, 1999) was used to assist participants to analyze and identify systemic interventions based on the previous steps. The key systemic interventions include reduced production costs and enhanced product prices for improved income, enhanced production efficiency for lightened workload and improving health via enhanced production efficiency and eco-friendly production practices (Figure 3a).

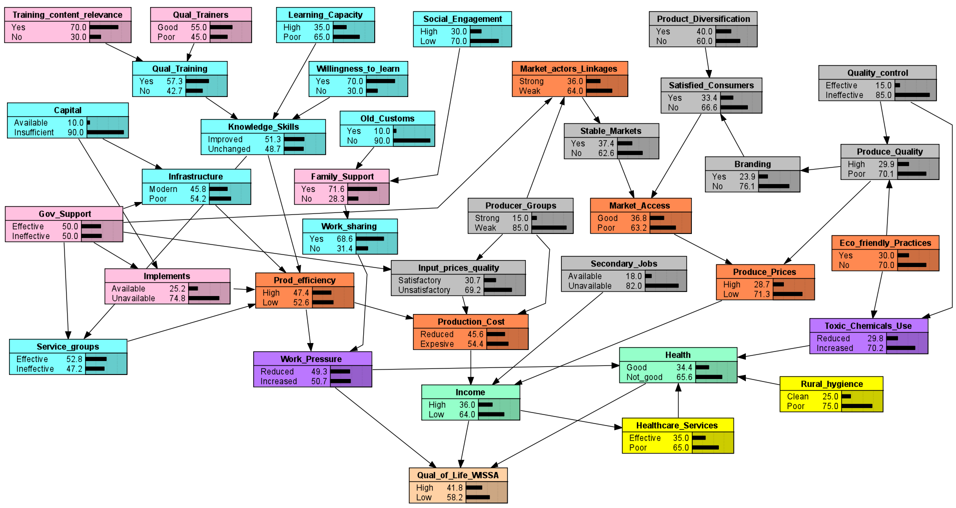

Figure 3a. BBN model for the current situation of the rural women in Haiphong. *Notes: WISSA stands for Women in small-scale agriculture. Pink, orange and violet colours represent systemic interventions for reduced work pressure, improved income and health, respectively.*

Figure 3b quantifies an estimate impact of life quality improvement for the women smallholders due to the changes of the defined systemic interventions. Income improvement was found to be the most influential factor, followed by reduction of work pressure and health, respectively (detailed analyses and figures will be provided in the full paper).

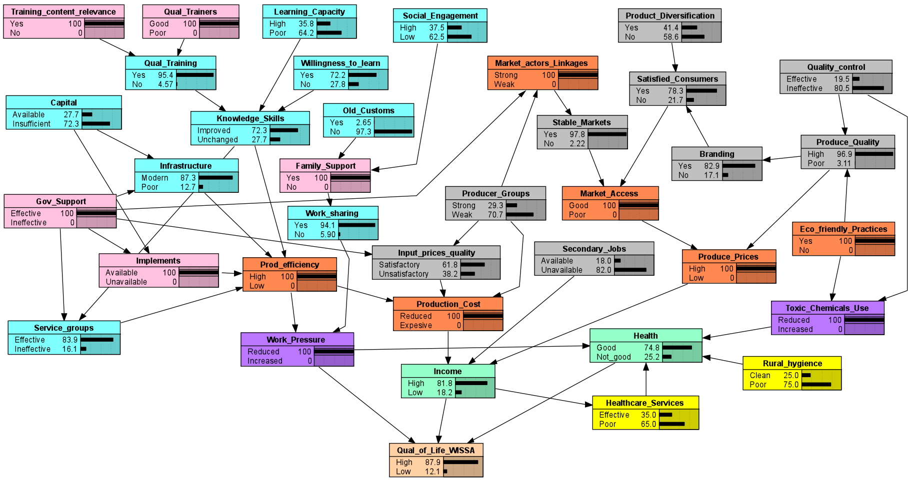

Figure 3b. BBN modelling for systemic interventions to enhance the quality of life for women smallholders in rural Haiphong

Based on the results, an integrated master plan was formed (Figure 4). The detailed plans with prioritized initial actions will be further discussed and refined with the participation of all the stakeholders in the second fieldtrip (scheduled to be in March 2014). Specific implementation plans for each district will be elaborated based on their particular contexts and the priorities of the local people before actual implementation (Step 6).

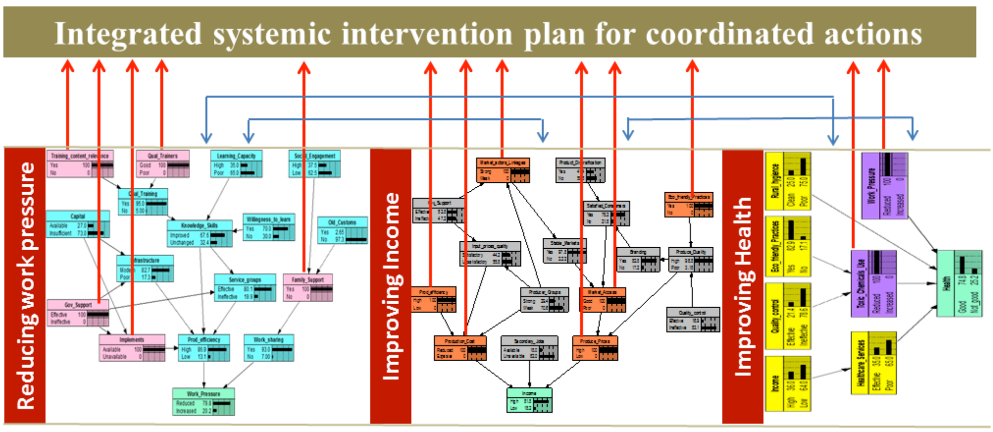

Figure 4. Integrated master plan for improving quality of life for women smallholders in rural Haiphong

Our findings also indicated that involvement of market actors (wholesale traders, agribusiness enterprises, processors and exporters) in the coming steps will be essential to achieve practical and effective solutions, better market access and thus improved income for the women farmers.

Through implementing the first five steps of the systems-based Evolutionary Learning Laboratory (ELLab) framework, it can be concluded that to enhance the quality of life for women smallholder farmers in rural Haiphong, a systems - based approach and full participation of all relevant stakeholders are essential to formulate appropriate and practical management plans. The three interrelated determinants for quality of life were, in order of importance, income, workload and health. Effective policies in support of production devices, input quality price and quality control, capacity building, local producer group development, and market access and linkages would be crucial, while at the same time, facilitating local participation, initiatives and empowerment are of equal importance.

The formulated systemic interventions will provide a basis for further discussion in the coming steps to achieve realistic and applicable management strategies. Reflection and lesson learned from this case study will be shared with other similar case studies in other regions through a web-based Global Evolutionary Learning Laboratory (GELL) for an advanced level of co-learning and management performance (Bosch *et al.*, 2013a; Bosch *et al.*, 2013b; Nguyen & Bosch, 2013).

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Changing global mindsets: convergence & activism

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Abstract: Research on the application of Evolutionary Systems Design to Information and Communication Technologies began over a decade ago under the direction of Bela H. Banathy at Saybrook University. In the ensuing years, continued research resulted in the emergence of a meta-theoretical framework, Evolutionary Guidance Media-Integral (EGM-Integral), a Systems of Systems (SoS) design that lends itself to ongoing evolution. Spanning ten dimensions of human activity, the framework provides action-oriented systems scientists with a blueprint for communicating and interconnecting real world initiatives in systemic sustainability through information technologies. This research applies the framework to an on-going exploration of the impact of ICTs on global mythos, specifically, the "heroic imagination" via an investigation of ICTs on three areas traditionally associated with heroism, previously identified as martial (military) heroism, civil heroism, and social heroism (Franco, Blau, Zimbardo, 2011, p. 101). These are investigated in light of changing risks (e.g., drone warfare, digital surveillance, online activism) and our changing situation (cloud computing). The purpose is to stimulate dialogue among action-oriented systems scientists around the nascent topic of *collaborative heroism*, a new form of social heroism, emerging from the intersection of convergence, citizen activism, online participation, and changing global narratives. Collaborative heroism expands the mythic terrain of the so-called, digital humanitarian, and is hypothesized to increase individual agency and result in a more engaged citizenry capable of addressing global challenges and promoting a global eco-civilization.

Keywords: Information and Communication Technologies; Systems sciences; evolutionary guidance media; convergence; social media; citizen activism; mythos; digital humanitarian; collaborative heroism

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World whereto? A transdisciplinary view to guide change

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Abstract: The fate of our world is executed on the evolutional and the global range. Multidimensional threads connect remote events, processes, politics. Tensions aggravate the scarcity of life resources. Power plays between continents affect the future reservoirs for life. Power play targets operation, invests, follows strategy. Vested interests prevent innovation, take hold of commodities, prepare guns. Complexity culminates: in systems, in cybernetics; in human behavior, in society, in bureaucracy. A shared vision of societal guidance is missing. Change must not just happen, it needs be guided. Humankind writes its own history. How to achieve a systemic modeling base to guide change? To prevent conflicts to explode into destructive wars? How to find a balance between opposed interests, to guide and to control complexity and semiosis evolvement? How to attain reliable orientation on action and option space? But an overarching advanced multi-model analysis can provide the base for planning, for political/economical investment and for a (learning) strategy. The model should support simulation to ground systemic learning from strategy to intervention to control. - Too meet social complexity and changing value systems grounding societal targeting three base modeling approaches are offered. First, *logics, mathematics* and cybernetics cover formal principles. Second, *evolution* rules life dynamics in complexity/semiosis evolvement as in (socio-) biology and socio-cybernetics. Geology, environmental science, psychology and behavioral sciences supply scaffolds. Third*, paleo-history and history* provide 'narratives' to be analyzed. The *epistemological integration* of the formal, the evolutional and the historical drivers reveals *structured probabilities of possible futures gained in an continuing learning process*. A major challenge remains strategic intervention to attain societal targets set. The issue is highly complex and in methodical aspects controversially discussed. Complying with requisite variety in targeting and control systems guidance is perceivedas a systemic learning process. 1. Prologue explores the complexity dynamics of the societal state and development. Societies are 2. addressed as Anticipatory life systems governed by evolution and history. 3. Narratives and scenarios elucidate historical archetypes in recurrent developmental structures. 4 Transdisciplinary integration opens steps to 5. Blueprints for societal design. 6. Epilogue reveals the limits of structured probabilities.

Keywords: Global evolvement, change dynamics. Modelling: cybernetics, systems; evolution, history. Complexity- semiosis- dynamics; socio-biology. Transdisciplinarity. Strategy learning intervention.

Acknowledgement: The argumentation reflects lifelong learning in controlling and innovation practice, in teaching and consulting related to strategy control.. – The author gratefully knows himself indebted to partners for contributions in continued personal dialogue and in cooperation with scientific societies. The specific literature on societal design needs to be discussed elsewhere. The references had to be reduced to a minimum.

This extended abstract is available from http://emcsr.net/book-of-abstracts/

1 Prologue: Modeling Societal Dynamics

Change and guiding change is approached threefold: from formal, from evolutional and from historical modeling (narratives). Conceptualizing society towards to guide, to strategically design and to control society appears as old as social leadership and government. Even suffering from protracted inertia to reform, societies change with their environments and visions. Rapid and fundamental shifts aggravate the need to guide change to the threshold of either further development or stagnation and decay. Transitions connected will invariably cause tensions or even revolutions. Unguided scarce energy will be wasted and sparse resources spoiled. From Hammurabi to Solon to today's societal transference, from local to global shifts, therefore societies tried to design and to control themselves by deliberate policy; be it by dictatorship or through parliament. The essential drivers of incremental change are manifold, if willful from within or forced from outside. They cover e.g. environmental pressure and conquest, competition and joined empire building.

0. To model as to to re-mould society: which qualities do constitute a society? Which forces strengthen it, let it grow, weaken it, which eventually cause anomie or destruction? Is there an ideal general type 'society' the real societies can be identified as subtypes of? Societal intervention (Midgley) relies on modeling. Societal systems thinking for example centers on communication (N. Luhmann) or institutions (recently N. Ferguson) or networking (strong and weak links, Czermely**)**. Attempted here is an overarching view. It connects the formal systems models societies that can described by and analyses their evolutional and their historical base. Following the 'epistemological turn' during the last two decennia a multitude of analytic methods has been re-invigorated or newly developed. Answering the urge to overcome dilemmas and tensions by systemic design and control the differing approaches need be integrated into a systemic framework. The outcome cannot be a 'unified theory' nor 'one' general model. Instead the overview intends a methodical and conceptual toolbox to adapt according to the particular case and environments. It should permit to retrace the conditions and sources of the actual modeling, to test it for contingency, for sufficiency and robustness. It should permit comparison with successful models of similar actual cases. Intended as a continuous learning device it ought enable to construct a retraceable modeling strategy for the actual case.

The method clusters following are centered around *cybernetics and systems.* The differing models*: formal, evolutional and historical*, are described specifically as to their analytic and heuristic functions. They will be tested as to their potentials to complement each other under a *transdisciplinary* concept. Owing to the topic they focus on general systems and life systems and their evolvement. They are centered in particular on social and societal systems within their historical scaffold.

1. The base *formal* notion (from *Aristotle to Robert Rosen's* 'relational modeling') appears relation: any unit exists but in relation to other units. Regularities indicate shared patterns. By repeated distinction, event and/or observation, dynamics take shape; in its simplest notion as a sequence. Recurrence may but repeat the same pattern or be connected with change. Recurrence recurring to itself as in the oruboros constitutes the basic form of re-entry, one essential foundation of Life. Larger sequences form rhythms and/or cycles, which constitute the basic formal correlation of Life (and with that of its complexity). Systems and cybernetics of higher order emphasize the role of the observer, if endo- or exo observer, or whether mere observer or participating in action ('obserpant´, Vrobel. Reality is what we observe as such and co-act with. How we perceive and to evaluate relevant surroundings, co-determines any action. Perception to be stored gives rise to description systems, all

kinds, all manifestations. Description systems imply merely formal models as grammar or basic mathematics. When languaging the observer attaches meaning, being a life system striving in anticipation of meaningful signs for survival and development. 'Pure' most simple mathematical relations, if there is such a notion, can be hypothesized as formal models. Basic mathematics yet can be 'enriched' towards life relations as e.g. in chemistry (perplex numbers, J. Chandler). Or they include dimensional re-entry as e.g. in calculus (Laws of form, Spencer-Brown) or dimension (plane, Moebius-Stripe, Klein-Bottle; D. Rapoport). Numerical mathematics (reflecting quantity) give rise to algebra (indicating time) joining geometry (space). Fractals embody granulation as by observation and determining observation (micro-scope, macro-scope). Fuzzy systems describe the dynamics of distinctions and borders. Advanced statistics manifest the laws of probability; what may happen, what may not happen, and when and why.

Life thus is grounded – and cogently pre-formed and constrained – in formal relations. As indicated above the interface connecting formula to life is shaped by the observer and his perceptional apparatus. Through perception and fine-motoric control the rise of consciousness and higher consciousness are predestined, implying an pro-active epistemology. Life evolved to ever higher forms and more numerous levels of complexity and continues to do so. As the precondition any life manifests in the embodiment into the life body. The life body contains its own evolvement and with that its higher consciousness. Employing the formal laws governing also matter, life manifests in physics and chemistry evolving/constructing physiology. The nervous system culminates in systems exerting deliberate, meaning guided control governed by consciousness and higher consciousness. In short: Life grounds o n calculus (Spencer Brown). Life is biophysics and biochemistry, is physiology, is bio-systems and bio-cybernetics.

2. Evolution. To remind: social systems are *life systems* emerged in (co-)*evolution* with their outer and inner environments. The are subject to and result of the rules of evolvement (Coen). Life systems are anticipatory systems (R.Rosen, D. Dubois) guided by meaning (Hoffmeyer). From the primeval urge to survive and to procreate, meaning differentiates into priority and value systems. They may grow into mental constructs as e.g. into highly complex value based ideologies or religions. Incidentally life systems incorporate extremely complex meaning systems obeying the rules of complexity dynamics. As any other complex dynamic system they are subjected e.g. to bifurcation and phase transitions, the latter eventually happening as catastrophes. Abbreviated: life systems act as *complex adaptive systems (CAS)*. They respond to altering life conditions and in co-evolvement actively affect these very states. AI highly complex systems of levels and hulls contains inner and outer environments and inner/outer (non-)participating observers (Vrobel). Memorizing descriptive systems differentiate from merely responsive behavior as in ameba to external gestures, signals, signs and spoken language in humans (not mentioning ICT). Sign based interconnection grows into social communication. Within the socializing human species languaging and communication constitute societal units. Originally accidental pairs and/or clusters institutionalize into societies. The main drivers of such evolvement are constituted in mutual co-efficiency by complexity dynamics and semiodynamics. With civilization and culture they climax in the mento-sphere of mental constructs. Cybersemiotics (Brier) delineate the progressive 'languaging' of communication and control, combining complexity dynamics and semiosis dynamics. Beginning with oral, written, and printed media the externalization and technology of information and communication is rapidly approaching a critical final stage via digitalization (ICT). The historical situation thus emerging grows hypercritical for the very nucleus of the coherence of societal systems. With rapidly

changing ways of social communication e.g. value systems lose cores of their tradition bound socio-biological base.

3. *History.* Society grew as a highly complex historical system (Wehler). Accordingly the historical courses vastly differ, due to the internal and external environments shaping the societal systems propensities. The historian Ian Morris (Morris) e.g. proposes as indicators for the general historical forces and states a) social/societal evolution; b) prevailing geographical and c) demographical conditions. A more detailed overarching view will base on the 'narratives' depicting complex systems of historical societies, examining their emergence, their constitutions and their development. The focus of the methodical inventory will lie on archetypes of historical developments, (Schwaninger). Simplified: history is seen a complex dynamic system described by learned narratives alias historical descriptions and regularities extracted. To anticipate what needs be later elucidated in detail: the analysis employing complementing methods will constitute an multidimensional network of historical patterns and related probabilities indicating probable tendencies for further courses in like cases. Due to the multi-perspective the probabilities extracted can be structured relating to past developments under comparable conditions. Evolution and history never repeat exactly. But they follow patterns, similar systemic conditions given. Each historical case represents a complexity in state and in dynamics, unique yet comparable. There are no simple, but rather opaque analogies. But variatis variandis useful patterns in appropriate confinement extracted may help to evaluate actual cases as to their developmental propensities. Those patterns provide information concerning preconditions, configurations. They may show which measures had been tried to control the course of societal history and which results were achieved: operational, medium and long term (de Toqueville). Even 'singularities', as actually total societal control menacing via ICT, can if cautiously be analyzed against historical scenarios as those of the invention of print and mass printing. ..

4. *Transdisciplinarity.* With science as means to co-act with life environments *epistemology* is affected; directly and indirectly. To enumerate but the obvious: growing access to data influences the entire design of inquiry systems; as do complex modeling and data crunching, big data, computer based proof, the looming complete loss of information ownership (as of privacy) and related expansions. New opportunities are added, others dwindle or change. Inter- and cross- disciplinarity need be supplemented by *overarching transdisciplinarity*. Mental archetypes aforementioned as distinction (Bateson), (re-) re-entry (Rapoport) and calculus (Spencer-Brown) or, on another level, fractality, are to be reconsidered concerning their root functions for scientific thinking. Paradigms as for example circularity, self-organization and autopoiesis originated in biology and cybernetics. In adapted guise they begin to get foothold in ever more disciplines e.g. in the social sciences. The scientist itself as an individual unique person becomes a critical since biased element within the entire system 'science'. With the inclusion of non-physical 'soft' sciences current principles of scientific discovery derived from physics become obsolete as the sole epistemic foundations. A 'New Science' or, relating to cybernetics, 'Science II' is emerging not least from practice experience in the societal sector. It is increasingly developed and executed for more sophisticated insight e.g. into societal affairs and mental processes.

Evolution emerges as the paradigm governing transdisciplinarity. It even touches hard disciplines as physics and chemistry (as in cosmology, micro/nano-biology). It penetrates biology, social evolution, social sciences, humanities; embracing any hyphen disciplines as for example paleo-history. As pointed out above: evolution determines also history and in particular world history. In the latter case historical narratives are analyzed under systemic aspects and evaluated for recurring patterns. Transdisciplinarity cannot be conceptualized towards to explore the world 'as it is' if not recurring to the world's 'as it emerged' and thus to evolution. - The approach to transdisciplinarity will necessarily rely on the proposition of a set of base models covered by evolution. In a nutshell: evolutional models set on with (0) the primeval potentiality field wherefrom matter spontaneously manifests. Systems (1) connect and structure dynamically. (2) The process of evolution is driven by (3) complexity dynamics and (4) semiosis dynamics and their mutuality. (Eu)-Sociality and language based communication spawn with language civilization and culture. A (5) mento-sphere of pure mental constructs as ideologies appears. All models interact multifold, shaping history and further evolvement.

Omitting cosmic events, evolution proceeds by emergence and by constraints proliferating by creation and destruction cycles co-acting with outer and inner environments. In societal evolution and history human interference leads to acceleration or retardation, to postponing, to culmination, to disturbations. It intervenes with the evolutional process of the creative emergence of the new and of the destruction of the obsolete. That will eventually lead to congestion and to tension culminating in implosions or explosions. To reduce revolution to the unavoidable and favor steady development by guided intervention an evolutional design of societal design and control becomes cogent. It needs to obtain the character of deliberate controlled learning. To support relevant systems, their dynamics and the historical narratives need be analyzed recounting their evolvement. The future can be forecasted if at all in most limited uncertain mode under presumptions set. Threefold based: formal, evolutional and historical, the resulting design model will represent but a ‘Multi-dimensional Modeled Network of Structured Probabilities’ to *systemically learn* from for the targeting and the design of policy and intervention.

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Knowledge brokerage for a sustainable Europe: a systems thinking approach for increasing the impacts of research and promoting evidence based policy making

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Abstract: In the course of the EU funded project RESPONDER we applied systems thinking approaches for linking different communities: scientists and policy makers, sustainable consumption and growth debates, pro-growth, green-growth and de-growth approaches. In this paper we present our findings and experiences and discuss the challenges of knowledge brokerage in the are of sustainable development.

Keywords: Participatory System Mapping, Knowledge Brokerage, Sustainable Consumption, Economic Growth

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1 The Need for Knowledge Brokerage

Scientists and policy makers follow different rationalities. The function of the system of science is to create knowledge, whereas the function of the political system is to devise and enforce collectively binding decisions on diverse issues, which in recent years increasingly need to be legitimised through the use of scientific knowledge. Research and policy making can be conceptualised as separate cultures, with important differences in terms of incentive structures, values and narratives, organisation of work, time horizons and language. In terms of knowledge they possess different perspectives on salience, credibility and legitimacy of knowledge as well as its use and ways of dealing with uncertainty. Research shows that academics have often very limited understanding of the culture and working environment of policy makers and lack awareness of benefits from learning more about these (e.g. Clark & Kelly 2005:21). Sustainable development raises significant challenges for both science and the political system. For science it represents a highly complex set of interrelated scientific questions transcending traditional disciplinary boundaries, thereby requiring inter- and transdisciplinary approaches as well as methodologies able to provide systemic insights and deal with high levels of complexity. For the political system sustainable development represents a highly complex set of interrelated policy issues transcending traditional sectoral policy boundaries. Due to this and other structural features (large geographical and temporal scale, high number of stakeholders, uncertainty...) sustainable development presents significant challenges to the political system, with new structures and processes for horizontal and vertical policy integration, stakeholder participation or knowledge elicitation in high demand. Knowledge brokerage has the potential to help manage these challenges simultaneously in both social systems. Knowledge brokerage for a sustainable Europe needs innovative tools. In recent years, increasing attention has also been paid to knowledge brokerage on environmental and sustainability issues. However, although a number of approaches to increase the connectivity between science and the political system through knowledge brokerage exist, systems-thinking approaches have not been used before.

2 The RESPONDER approach

The RESPONDER project (www.scp-responder.eu) has developed and tested an innovative method for knowledge brokerage between research and policy making based on a transactional network understanding of knowledge brokerage and a systems thinking based approach that goes beyond pure knowledge transfer and adds a network element of allowing science and policy-making to enhance their connectivity through a social process. As a result, scientific knowledge cannot be perceived as pure facts, but as broadened by contextual information, world views, values and judgments. RESPONDER combined on-site-events and online-information-services and focused on contradictions between sustainable consumption and economic growth. Three European Dialogues dealt with the topics of: economic growth; the green economy; and the role of innovation. Ten thematic workshops highlighted different fields of sustainable consumption: food, mobility, housing, finance, and communications technology. The key challenge of the project was to improve the mutual understanding of research and policy making on the one hand and of the "pro-growth community" and the "beyond-growth community" on the other. We chose a systems thinking approach and applied participatory system mapping (participatory construction and analysis of causal loop diagrams) in an attempt to link the high-stake policy areas of sustainable consumption and economic growth, while engaging different actors' mindsets, paradigms and rationalities. In the first round of events, participants jointly created system maps on particular topics of relevance to the overall theme of the workshop. For example, in the first European Dialogue, one group focused on the topic of food and generated a system map addressing the question: "How does increasing consumption of regional products affect the employment in domestic agriculture?" In the second round of events these maps were used to discuss further questions such as "Where are the job opportunities?", "Where are research needs?" or "What policies could lead to a transition of the system?" Both the mapping process and its results were documented and further processed in the EU dialogues and project meetings. In a number of cases the system maps were developed to a point where several different world views were made explicit, color-coded and embedded into a single map.

3 Insights

By applying a systems thinking approach to knowledge brokerage we gained (1) issue-specific insights with a special emphasis on system dynamics, (2) insights enabling generalisation and transfer of understanding between issue areas, (3) insights into different mindsets and world-views of policy makers and researchers, (4) 'inter-issue' insights into the interlocking of individual problem issues and higher level of system organisation (Sedlacko et al. forthcoming). We have experienced the discussion-supporting function of participatory system mapping, which is particularly relevant for knowledge brokerage processes involving representatives of various communities. Furthermore, we found that diagnostically used system maps possess significant policy-relevant potential by enabling identification of leverage points which serve to conceptualise policy interventions and by supporting thinking about effectiveness, policy resistance and potential side effects of policy interventions. Structuring the problem issues using a systems thinking approach also allows identification of missing evidence and knowledge needs of the policy makers and therefore supports the development of new research questions, areas and agendas.

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Needs, quality of life and sustainable development – an inclusive development concept

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Abstract: This contribution draws upon an idea of needs, of quality of life and of sustainable development in order to elaborate an approach to the idea of "a sustainable, good life.

Keywords: needs, quality of life, sustainable development, resilience

Acknowledgement: This paper is a shorter and modified version of a study that was published by the Federal Institute of Agricultural Economics, Vienna (Quendler 2011).

1 Introduction

For many people resilience, sustainable development and the quality of life are “vague” concepts, which are nonetheless omnipresent in the media and which have long been implicit or explicit political goals. These terms are central for the “key concepts” of the third millennium and thereby constitute a challenge when considering the satisfaction of the needs of every human being, today and in the future.

2 Background

Everybody has needs. These needs are very complex and cover different dimensions, such as subsistence, work, health, family, free time and security (c.f. Frisch 1998; Maslow 1954; Max-Neef 1992; Nussbaum & Glover 1995; Sirgy et al. 1995). The fulfilment of these needs presupposes the availability and consumption of resources, causes feelings and emotions as well as effecting the environment.

Development means creating the opportunity that people be able to satisfy an increasing number of needs daily without restriction and be able to evolve socially, culturally and individually. Little is known of what will shape the needs in the future. The consensus is, however, that it will have little to do with economic growth, i.e. the increase of gross domestic product (GDP). (Quendler 2011, p.9).

On different levels – politics and science – it is being pointed out that the primary goal of progress or the development of society should be a “better” life for both the current as well as the generations to come. Since it is difficult to portray directly this better, or “good” life (c.f. Quendler 2011), there is a need for appropriate plans, models and methods which facilitate its study and enable one to draw concrete conclusions (c.f. Brundlandt 1987; Campbell Converse & Rodgers 1976; Statistics Sweden 1997; Zapf 1984).

2 Clarifying the concept

The purpose of sustainable development is to create and maintain prosperous social, economic and ecological systems throughout the world (Folke et al. 2002, p.1). Humanity has a need for persistence. And since humanity depends on the services of ecosystems for its wealth and security, humanity and ecosystems are inexorably linked. With sustainable development and this idea of quality of life in mind, humanity, therefore, must strive for resilient socio-ecological systems. Furthermore, “*when considering systems of humans and nature (social-ecological systems) it is important to consider the system as a whole*.” (Walker & Salt 2006, pp.38). From this perspective, sustainable, good life (Quendler 2011 p.46) is a multidimensional inclusive development concept which

(i) takes into consideration the flows of resources (natural resources, human resources, material resources, social resources and financial resources) in social-ecological systems which are complex adaptive systems that do not change in a predictable, linear, incremental fashion;
(ii) results from the different immaterial and material needs at individual, municipal, national and global levels and the resources and services available for their fulfilment (objective living conditions for those needs);
(iii) refers to the experiences of human beings and that which they consider important for their lives and society and

(iv) describes a dynamic idea that includes the present but considers the future (time) and

(v) considers 'resilience thinking' as providing a framework for viewing a social-eco-logical system as one system operating over many linked scales of time and space. Its focus is on how the system and people changes and copes with disturbance.

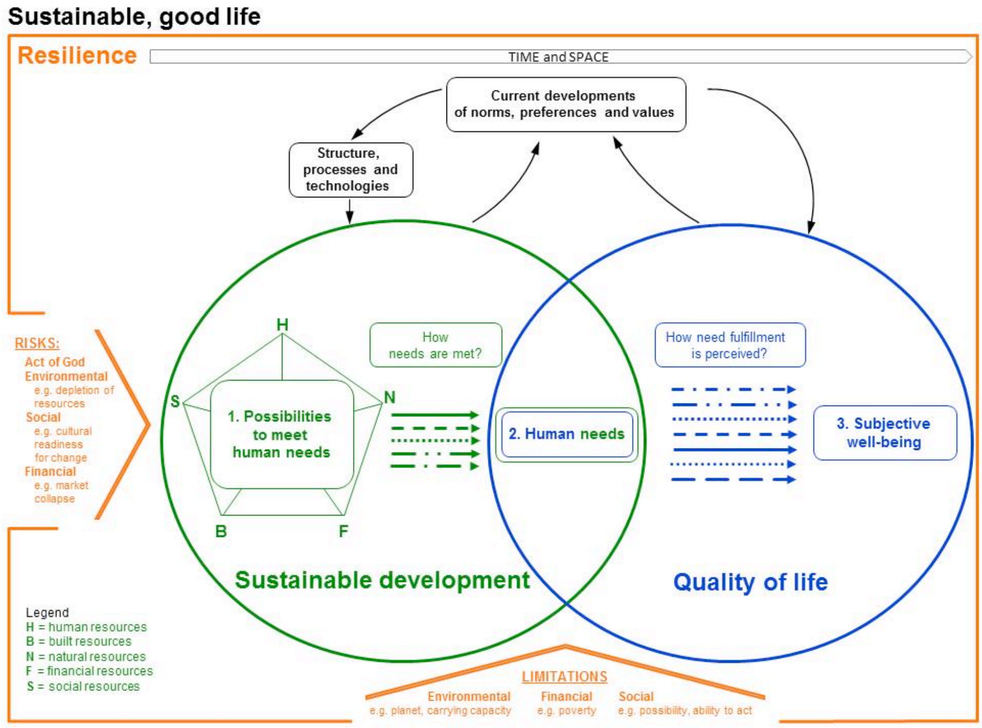

Figure 1: A sustainable, good life (c.f. Quendler 2011, p.47)

3 Conclusions and reflections

In conclusion, we have a long way to go before reaching a state of sustainable, good life. The time is right to embark on a new round of consensus-building processes that will re-envision what was institutionalised over the last 70 years. There is clear need for: (1) new goals with a broader view of interconnectedness among long-term, sustainable economic, social, and ecological well-being and its resilience and (2) better ways to measure progress towards these goals.

Finally, the theoretical outcomes of this contribution lead to the following potential field of research: Considering quality of life and sustainable development together represents an important focus for research: "what role does the ecological dimension and its resilience, as the basis of life, play in the quality of life?", "how do natural, human, material, social and financial resources influence the quality of life in connection with the policies adopted and the macro-conditions (both in the context of time and space)?" or "how do the life style or different life styles influence the quality of life of a person, or a group of people or a society or the environment and their corresponding resilience?" This forms a comprehensive research topic for future interdisciplinary work on sustainable development and the quality of life in order to identify connections and areas of activity as well as their effects on the resilience of socio-eco-logical systems. Furthermore, in order to measure sustainable, good life properly one cannot just consider the current situation. Any serious assessment of contemporary life should also bear in mind the future quality of life which results from current trends or how it is possible to include risks and fears both currently and for the future. (c.f. Quendler 2011, p.48).

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An education for a sustainable and inclusive world: a soft system dynamics intervention in Peru

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Keywords: SSM, SD, SSDM, Peru, education, sustainability, social inclusion.

One of the key strategic problems Peruvian society is facing nowadays is the low education quality standards for the primary and secondary levels within the Peruvian educational system.

The problem is complex and diverse political, cultural, economic, nutritional, social, logistic and geographic variables, among others, are interrelated in the problem situation that makes it a messy one, where the whole situation is difficult to analyze not enabling to define viable policies to implant for improving the problem situation.

In the PISA[1] examinations, where Peruvian students aged between 15 and 16 years participated in two instances (2009 and 2012), the outcomes for them were extremely regrettable[2]. In both occasions Peruvian students competed against to almost 560,000 students from around 65 countries, representing to 28 million of students around the world. Figure 1, shows a figure of the PISA report, 2012.

Some Peruvian educators affirm that the situation is being improved compared with the past, however the challenges and complexity of the problem-situation seems to demand a systemic understanding and comprehension of the overall issue, considering, besides, those soft issues that usually appear in the management arena of this kind of concerns.

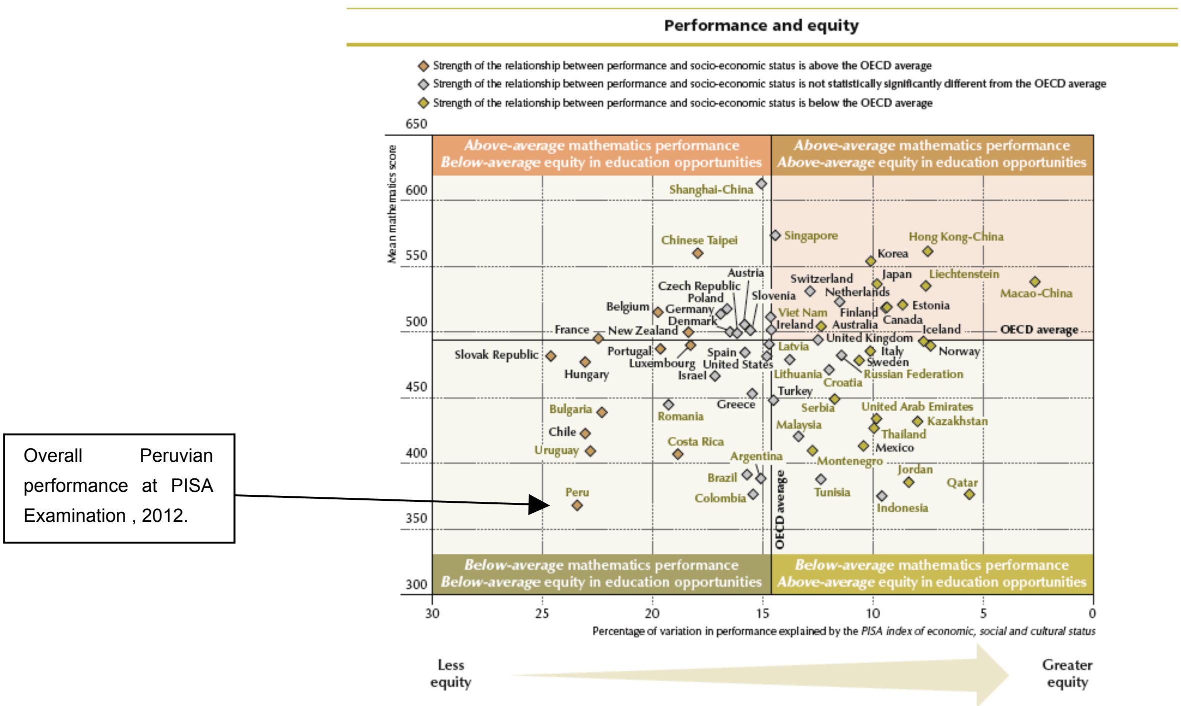

Fig. 1: Performance and Social Equity: PISA report, 2012, OECD.

The present paper is dedicated to show an initial study about the problematic situation of the Educational Sector in Peru, since a systemic point of view, trying to consider the diverse stakeholders involved in the situation, as well as the different kind of variables, hard and soft, existing when studying this issue.

The systemic methodology chosen for doing this study was the so called Soft System Dynamics Methodology (SSDM) (Rodriguez-Ulloa, Paucar-Caceres, 2005; Rodriguez-Ulloa,

[1] Programme for International Student Assesment (PISA), OECD (www.oecd.org/pisa)

[2] In year 2012, Peruvian students were in the latest position among students from 65 countries around the world, in the three aspects that the PISA´s examination records: mathematics, reading and science.

Montbrun, Martinez-Vicente, 2011, Rodriguez-Ulloa, 2013), a methodology that combines two widely known systemic methodologies: Soft Systems Methodology (SSM) and System Dynamics (SD).
Using SSDM, this research work tries to understand the problem situation since a hermeneutic, phenomenological and ontological stand points. For doing this, stakeholders were identified, and their desires, worries, aspirations, worldviews, level of power, ethics, interests, problem definitions and aspired strategic transformation processes for the problem situation were uncovered along the study, as well as their group alliances and conflicts.
As an innovative use of soft approaches, SSDM´s application made a philosophical shift, abandoning the anthropocentric soft systems approach to include “worldviews” of human and non-human stakeholders (i.e those stakeholders representing the flora and fauna affected by human actions).
In the research it has been chosen two species who represent the Peruvian fauna and flora for this study. One is the Rana Gigante de Junin (RGJ) (a Peruvian giant frog which lives in the Peruvian central highlands and it is in an extinction stage) and the Algarrobo tree (ALGT) (a typical Peruvian tree which grows in the north west coast of Peru which is as well in danger of extinction).
Using synectics as one of the soft approaches used within SSDM, this research took both of them (RGJ and ALGT) as stakeholders, in the idea to propose a viable transformation in the Education sector, considering the “point of view” of human and non-human stakeholders. This means to propose, if possible, a non zero sum strategic transformation process concerning policies to be applied in this sector, affecting all their stakeholders within the sector.
The hypothesis is that if Peruvian educational system continues to be based on reductionism, positivism, objectivism, memory-concepts oriented learning and teaching to describe the real world under an ontological approach, then the probability that the educational performance of students will be similar to previous Pisa reports and the educational process will be less social inclusive and affect negatively to the Peruvian flora and fauna in a great manner than if the Peruvian educational system adopts a systemic, integrative, epistemological, phenomenological and hermeneutic approach, where it is expected students will be more open minded, having the capacity to integrate concepts, and their process of learning would be based in specific experiences through a problem-oriented approach, and thus a more sustainable and social inclusive and respectable world would be created for future Peruvian generations, under the practice of an Educational system based on these philosophical roots.
In the present study and using System Dynamics (SD) models a part of SSDM, both scenarios are examined along the next 36 years (until 2050), in order to see the outcomes when adopting policies base on each of them.
Applying the SSDM´s stages, the problem situation is structured, stakeholders are identified and relevant systems and root definitions oriented to some whole problematic issues (according to the preferences of each stakeholder) on the Problem Situation are derived, considering in each time, the world view of each stakeholder.
These problem-oriented root definitions allows then to derive problem-oriented conceptual models from a range of stakeholders (including RGJ and ALGT) since those who have traditional world views on educational strategic issues to those who propose to implant radical changes in the Peruvian educational system . An issue based and a validated primary task model (Wilson, 1984, 2000) of the problem-oriented strategic transformation is done and a consensual problem – oriented SD models are derived and tested along time (till 2050) for ill structuring problem understanding.

After that, some solving oriented structural changes are proposed, using the problem-oriented consensual SD model obtained previously as a tool of reference, and their cultural feasibility and systemic desirability are tested, in an trial and check process through simulating the scenarios these changes generate, using and modifying the SD problem-oriented model obtained before as the platform for this analysis, until to obtain strategic changes that could radically modify and "improve" the course of action of the problematic situation along time (measured with diverse indicators) and validating that those changes accomplish their desirability and feasibility with the range of stakeholders (including RDJ and ALGT) .

At the end, an action plan based on the policies derived from the scenario analysis done using SD models is designed in order to create political, social , cultural and economic environments that allow to significantly improve the performance of Peruvian students and to create a more sustainable and inclusive world for Peruvian society in next decades, through a viable, systemic and integrative change in the Peruvian educational sector.

The paper ends with the analysis of some further research needed to be done in the future on theoretical developments of SSDM and its use and as well on issues concerned to the Peruvian educational system, where diverse and abundant learning points arose along the study and need to be deeply reflected for further SSDM´s applications in this sector, in the future.

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Shaping future together: transdisciplinary collaboration for sustainable urban planning

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Abstract: Planning for sustainable urban future is a highly complex issue and requires different bases of knowledge and experience. In this context, transdisciplinary (td) research offers a framework for involving scientists and societal actors into a common process of knowledge production, mutual learning and solution finding. However, managing td collaboration is a challenging task per se, as competences in communication and interface management are crucial success factors, yet not usually part of standard profile of researchers. The city of Korneuburg, Lower Austria, initiated a very bottom-up td project in order to formulate a planning principle to get fit for a sustainable future. Methodologically, the project was based on participatory scenario development – involving not only scientists from different disciplines and local partners, but also professionals for facilitating the participatory process and moderation. Our experience with this actor's constellation revealed a distinct gain in process quality and project results.

Keywords: transdisciplinary collaboration, facilitation, collective learning, empowerment, scenario development, urban planning

Acknowledgement: At this point we would like to highlight the great commitment of representatives and citizens of Korneuburg, who dared the adventure to attempt new ways of communicating and negotiating with each other and stepping into discourse with science, not being scared of loss of power and leaving suspect and hierarchical struggle behind. Many, many hours of volunteer work were done in order to elaborate a common future vision for their living environment

1 Introduction

In urban development decision makers are challenged to create future strategies, which comply with highly complex issues (e.g. considering demographic or climate change or a variety of interests and actors involved). Despite usually unforeseeable changes and insecurities, decision making in the present should be forward-thinking, reflected and sustainable (Kosow and Gaßner 2008; McDonald et al. 2009). Participatory procedures, involving scientists and societal actors as well as knowledge users are regarded as critically needed in order to address such sustainability challenges (Lang et al. 2012). Transdisciplinary (td) research designs may therefore provide an integrative framework as they promise grasping uncertainty and complexity of problems ledge (Pohl & Hirsch Hadorn 2007), knowledge production, including collaboration between actors from within and outside academia (Mobjörk 2010; Pohl and Hirsch Hadorn 2007) and the capacity of integration of different knowledge types (Truffer 2007; Hirsch Hadorn 2005). In terms of sustainable development they foster learning processes and can facilitate effective participation that may lead to empowerment of people involved and thus societally more effective research (Lang et al. 2012; Mobjörk 2010; Elzinga 2008).

Nevertheless, the management of td collaboration is a challenging task per se, as competences in communication and interface management are crucial success factors, yet not usually part of standard profile of researchers (Truffer 2007). Knowledge on how groups and teams productively work and learn together is vital to shape an effective collaboration process, involving multiple actors from different backgrounds. This paper will discuss the role of professional facilitation and moderation within td research activities.

2 Korneuburg 2036 – shaping future together

Our assumptions are underlined by experiences from a participatory scenario planning process in the city of Korneuburg, Austria. This bottom-up project involved local ownership (the project was initiated by citizens and co-financed by the city), broad local involvement (representatives of all political parties and administration, civil society groups and citizens), an interdisciplinary scientific team and professional facilitators for participatory process design, moderation and post processing after the end of the research project.

The methodological framework relied on building stones of formalised scenario analysis, a structural and development analysis combined with normative future visions of stakeholders and a participatory process giving special attention to community building and empowerment of local actors.

3 Discussion

The recently conducted process showed, that the scenario method was very helpful for the integration of expert and lay knowledge into four scenarios for future development of Korneuburg until 2036. Incidentally, it created a framework for social learning on the question of what constitutes desired urban development and – maybe even more important – it generated sense of community, identity and social capital among those who will have to implement the future strategies by their collective action. However, equipped with knowledge and experience on group processes and needs, professional facilitators had a central position in quality assurance of the participative processes. They contributed by securing the fairness of the procedure, balancing hierarchical structures through a neutral intermediary role between science and practice, creating trust and transparency in communication and cooperation and overall contributed to the quality of cooperation through their knowledge on and experience with group (dynamic) processes.

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A multidimensional "ECONOMÍA AMABLE": co-creating desirable futures

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Abstract: To shape a desirable future we must undergo a profound cultural metamorphosis. This paper presents a concept of an economy kind to people and to nature, Economía Amable, to accomplish this transformation. Our study depicts that a Creative Society can be developed to address the challenges of reaching the goal of a desirable future: By study-reflection-conversation-pause-education-dissemination loops that bridge science and arts, philosophy and technology a renewal of concepts and practices can be achieved.

Keywords: economy; sustainability; autoecoethical responsibility; transdisciplinarity; creativity; education; learning contexts; collaborative co-creation; prospective imagination; conscious evolution.

1 Desirable futures: a key issue

How to co-create desirable futures is a key issue. We present a concept of economy within the complex thinking framework to address biosocial sustainability: desirable and achievable by means of action-research practices. It is through human activities, particularly economic (producing-distributing-consuming), that the underlying paradigms reinforce the current ecological and social challenges. They take place in the lecture hall “Society” where one learns, relearns, and recreates concepts and practices of every field of knowledge and action. Nowadays, in a scenario of increasing complexity and interdependence it is essential to reframe the underlying paradigms in order to create favorable conditions for desirable futures in the local-planetary society. How can such a challenging transformation be achieved?

2 Prospective imagination in learning contexts: towards a Creative Society

To shape a desirable future we must undergo a profound cultural metamorphosis. It can be accomplished by study-reflection-conversation-pause-education-dissemination loops that bridge science and arts, philosophy and technology to achieve a renewal of concepts and practices. Such deep transformation implies the development of a local-planetary active citizenship. Awareness of the high interdependence in the biosocial web leads to autoecoethical responsibility which is a key component of the process. As well as purposeful action to take advantage of the available knowledge, and embracing the opportunity to consciously evolve, individually and socially.

We propose learning contexts of collaborative cross-pollination for a range of diverse social actors in order to foster a Creative Society. This Creative Society highly values the integral development of its individuals, their creativity and happiness. Such a society recognizes and trains the responsibility of each individual, its active citizenship.

Economía Amable arises from the Creative Society. In contrary to the current economy where finance tends to serve finance, and real economy tends to ignore principles of life, Economía Amable is kind to people and the web of life they belong to.

Intertwining different actors and fields of action is a mean to favor the process of developing shared/ transdisciplinary knowledge. This, in turn, will be useful to refresh concepts and practices in each field of knowledge/ action.

We use a desirable future scenario depicted in an essay of Silvia Zweifel as meta-space to engage in prospective imagination & spirited conversation. Some particularities of that desirable world probably reflect participants’ current aspirations and lines of action. Under that light each one is encouraged to share his/her ideas and experiences to reflect and find out where and how s/he can contribute to favorable changes. In fact we used this scenario in conversation meetings with the Asociación Obrera Textil de la República Argentina, the Argentine textile labor union. Their engagement resulted in the creation of an itinerant art exhibition. We hope to bring parts of the exhibition with us to show one vision of an “Economía Amable”.

3 A multidimensional Economía Amable

An Economía Amable is an economy kind to people and to nature. The Spanish word “amable” derives from Latin “amabilitas” which captures the core idea of “love in action”. Economic activities reflect the paradigms of a society. Its dynamics express the social capacity to generate value over time, genuine value for the sustenance of life and the personal-social flourishing. A Creative Society is capable of generating and cultivating economic activities that are “amable”.

Each person should be able to be in the world and to be happy. Individual-culture-biosphere are inseparable: it is in this multidiverse unity that the needs as well as the chances to satisfy those arise. Needs are satisfied by the individuals themselves or by the environment, but in the last instance always by the environment. There is a close interplay between personal-cultural trends and personal/ social circumstances in which need priorities are set from moment to moment. What prevails for each person, at each moment, shapes her/his personal life experiences and satisfaction. People who tend to develop greater awareness of themselves and their surroundings, and act accordingly, tend to experience more satisfaction: an autoecosatisfaction.

The current economy arises from a cultural system which drives the majority far away from satisfaction. Regardless of a low or high income, people seem not to be satisfied, may it be because they face difficulties to satisfy basic needs or because they constantly feel the need for something more. The prevailing economic model does not attend, nor support, the highest human aspirations. On the contrary, its dynamics not only provoke loss of sustainability, but also loss of sense and ability to recognize the intimate interrelationship of individual-society-biosphere.

However, a promising scenario is (still) possible. It requires a comprehensive individual-collective development. Enforcing collaborative efforts to drive learning spirals, a renewal of concepts and practices, and thereby enable an Economía Amable. In such an economy employment and growth, in traditional terms associated with the capital-labor interplay, are not goals anymore. Economía Amable denotes a shift in perspective:

- *Growth* is differential, qualitative, and aimed at the social inclusion and biosocial sustainability.
- *Productivity* moves from people to resources, and "maximizing" is considered in terms of sustainability at local biosocial systemic level.
- *Activities* are audited, prioritized, and vitalized on the basis of their ability to generate genuine social value to meet needs in a long term horizon.
- *The sources of income*, no matter if they come from a job, holdings of assets, derived from rights or welfare benefits, or others, are closely linked to an active local-planetary citizenship.
- *Benefits* mainly stay in/or return to the communities where activities originate.

These characteristics belong to a system dynamics where the web of life and the highest human aspirations are at its very core: sustainability can meet happiness.

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Is a vocational author with a strong interest in individual-collective learning. She dedicates her time and efforts to a particular form of research-action to foster a multidimensional Economía Amable and essays written in a less than common narrative form which weaves autobiographic relations and experiences with conceptual queries and findings.

Silvia is the current Secretary General of GESI (Grupo de Estudio de Sistemas Integrados), Civil Society Organization) – Argentina. She is founder of the Group Economía Amable, which she coordinates with Mechthild Adameit.

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I B
Impacts for sustainability: epistemology and research activism

Chairs

Dino Karabeg, University of Oslo and Knowledge Federation
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For many years systems scientists were considered theorists, people who had the know-what and know-how as well as the know-why to understand and describe complexity. But contemporary approaches to social-systemic evolution expand the domain of competency to include care-why and care-how considerations. Fundamental insights produced in the systems sciences have the potential to 'change the world' — provided they can be made more widely known and applied in practice. Through the power of knowledge media, researchers draw upon an augmented range of communications skills, materials, practices and tools to bring these systemic insights to broader attention. The critical offer of action oriented systems scientists of today for tomorrow lies in emerging ways to communicate and interconnect real world initiatives in systemic sustainability through information technologies that break the barriers of time and space. The workshop "Impacts for sustainability" will explore and begin to develop systems of systems (SoS) capable of 1) synthesizing high-consensus and high-impact understanding/learning/innovation relating to systemic sustainability (aka, thrivability) from various parts of the world, and 2) seeding these crystallized experiences in the public sphere through information and communication technologies.

List of Contributors

Dino Karabeg, Alexander Laszlo: Epistemology and research activism for impact: learning to be the systems we wish to see in the world

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Epistemology and research activism for impact: learning to be the systems we wish to see in the world

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Abstract: We answer to the challenge of sustainability by curating the conditions where *living* social-and-technical systems can emerge (capable of evolving and adapting to society's needs). In our initial systemic prototype, systems scientists collaborate with knowledge media researchers and developers, communication designers, media professionals, policy makers and other stakeholders, aiming to co-evolve a systemic solution among themselves that is capable of inducing similar evolutionary changes in larger systems, and in the society at large.

Keywords: Systems thinking, evolution, development, consciousness, creativity, thrivability, technology, social innovation.

Acknowledgement: *We build upon the CIEL and GELL projects that were initiated by Katrin Ananda, Ockie Bosch, Alexander Laszlo, George Pór and others in connnection with ISSS57 Vietnam.*

1 Introduction

One of the main challenges to humanity at this juncture in our collective history is to find systemic alternatives to either adapting the world to us or adapting ourselves to the world. The options in this direction must promote systemic sustainability, that is, integral approaches to human relationships between ourselves and other systems based on co-adaptation — strategies for adapting *with* the world, rather than either adapting ourselves to it or forcably adapting it to us (Laszlo, 2012).

We answer to those needs, and to the theme of this conference, which focuses on Systems Thinking in Social Innovation and Emerging Technologies, by curating the conditions for corresponding evolutionary changes to emerge in our midst (Karabeg, 2013).

1.1 Epistemology for research activism

As we engage with the process of curating the conditions for the emergence of a thrivable planet — listening into the nurturance spaces and seeking the systemic leverage points for the emergence of a glocal eco-civilization — it will be increasingly important for our species to continue to explore ways of fitting our individual melodies together to create sustaining and enduring harmonies with the broader symphony of life on Earth. This is more than just a nice metaphor: it is the essence of syntony. As an organizing force in societal evolution, syntony involves an embodiment and manifestation of conscious evolution: when conscious intention aligns with evolutionary purpose, we can foster and design evolutionarily consonant pathways of human development in partnership with Earth. It is the effort to cultivate these dynamics that constitutes what is often called a *syntony quest* (A. Laszlo 1999). To engage in a syntony quest, we have to learn certain skills, to develop and practice certain competencies, and to manifest a willingness to think and act interactively. The notion of "will" — of active intention and passionate purpose — is crucial here. In fact, it is what makes the difference between merely seeking harmony and consciously curating a constantly emerging syntony quest.

Our common quest is that of curating conditions conducive the ongoing emergence of life on earth, of ways of being responsible agents of evolutionary development while at the same time learning how to deal with the challenge of playing a meaningful role in an eco-civilization that has the potential to emerge amidst the dynamics of a rapidly changing world. This seeking of ways to become curators of life in partnership with Earth, of taking on the mantel of connectors of life with life, this is the contemporary syntony quest. It employs an evolutionary appreciation that is far removed from the popular conception of the Darwinian struggle for existence. And as with any significant learning adventure, the process of the quest is more critical than any particular outcomes to which it may lead. Through the ways of learning how to read and understanding the consequences of change that both shape and are shaped by us as agents of thrivability, we will find ways to shape our own response to the challenge of this syntony quest. Thrivable development is as much a function of our understanding of evolutionary processes as it is of our ability to engage with the dynamic change processes of which we are a part in a spirit that fosters the responsible co-creation of abundance. This understanding moves us beyond the important but limited visions and objectives of sustainable development. To curate the emergence of a glocal eco-civilization, it is no longer enough merely to seek to sustain our presence on earth. We must evolve our presence, and we must do so in the direction of collective thrivability in the context of ecosystemic abundance.

1.2 Technology of humane interaction

Technology is often portrayed as something apart from culture, acting upon individuals and societies in dehumanizing ways. There is a problem with such views, generally identified with technological determinism. The problem is that they separate technology from culture when in fact, technology is best conceived as a kind of *crystallized culture.* People produce technology — more specifically, individuals and groups in particular cultures produce specific technologies. What they produce, as well as how they produce it, reflects and embodies the values of their culture.

The specific challenge for technology is for us to consciously create Technologies of Organizational Communion (TOC) to contextualize and humanize the Technologies of Information and Communication (TIC) through which we create so much of our contemporary social, economic and political networks. To emerge a glocal eco-civilization[1] we need both the connective and distributive power of TIC and the humanizing and relational power of TOC. In this way, each TIC we produce will embody an evolutionary, planetary, and thrivability ethic that affirms life — and the quality of living it. In short, it is a challenge to our cultures; one to which only a life-affirming evolutionary ethos is appropriate.

1.3 How we intend to proceed

At the Impact for Sustainability: Epistemology & Research Activism symposium at the EMCSR 2014 in Vienna, systems scientists will collaborate with knowledge media researchers and developers, communication designers, media professionals, policy makers and other stakeholders, aiming to co-evolve a systemic solution among ourselves that is capable of inducing similar evolutionary changes in larger systems, and in the society at large. The symposium will consist of two 1.5 hour events: a Dialog where we shall co-create a shared vision; and a World Cafe where we shall begin to realize this vision in practice, extending beyond EMCSR 2014.

2 Dialog

We prime our dialog by sharing a brief Web documentary, where by using stories and pictures it will be shown that

- conventional approaches to global issues tend to be systemically misconceived hence strategically misdirected (there are systemic reasons why they don't and probably cannot work; which might explain the record of achievement so far)
- a different approach—through social-systemic re-evolution or *systemic innovation* as we sometimes call it—has not only the potential to bring us to a sustainable course, but even to an 'end of scarcity' (as Bucky Fuller predicted) and to global *thriving*
- by presenting them from certain angles, and using suitable communication design, this new strategy and the insights on which it is based can be given massive appeal (they can be turned into popular, viral, sticky… public issues)

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[1] A glocal eco-civilization is one that celebrates and invests in local expressions of thrivability while contributing to the emergence of global interdependence.

This Web documentary will be shared in advance, and only briefly shown at the dialog. The idea is to initiate a good conversation, and give it sufficient time. If we succeed, a shared sense of opportunity, and of commitment, will emerge.

In the dialog, we shall also discuss the closely related possibility to develop a *new paradigm* (in Thomas Kuhn's precise sense) in systems science, with new directions in research, new priorities and values, and new *kinds* of fundamental results. The word *epistemology* in our title points to this interest.

3 World Cafe

To prime the creative process, we shall share a draft of a plan for a systemic remedy to the above anomaly, an initial functioning model of which will be completed at our World Cafe .

Our proposed system design can be imagined, metaphorically, as a three-stage rocket, whose purpose is to use the power of new information technology to give the results and insights of systems scientists substantially higher visibility and impact.

In the **first stage**, the systems scientists propose, select, organize, explain… the insights that have the largest potential to positively impact society. Initially, this first stage is envisioned as an application of the tools and processes of DebateGraph; Dr. David Price, DebateGraph's co-founder, has agreed to advise us. From an academic or fundamental point of view, the challenges that this first stage presents to systems scientists illustrate the mentioned *new paradigm* .

In the **second stage**, the insights created, selected and explained in the first stage are made transparent, and more impactful, by using the skills and techniques of contemporary communication design. Fredrik Eive Refsli— a reputed Norwegian communication designer—has agreed to creatively contribute to this stage.

In the **third stage**, the results of the second stage are strategically placed into media and political campaigns. The choice of collaborators—to complete this minimal real-world model or *prototype*—is under negotiation.

The World Cafe, where we will finalize this *prototype*, will consist of three tables.

At the **first table**, we will discuss and select the insights to be federated. What can systems science contribute to the world, that can make a difference that makes a difference? How can we make those insights palpable, and obvious?

At the **second table**, we will co-design the federation process. How will systems scientists be selecting their impactful ideas, reaching consensus on their validity and value, and making them accessible—in the third stage—to media, policy makers and general public? What technology should we use to implement those processes?

At the **third table**, we will co-create the strategy for the third stage. How to put systemic insights into the media? And into politics and policy? In what way will the insights of systems scientists inform the evolution of key real-world systems? (Here too we will prime the group creative process by some concrete proposals.)

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About the Authors

Dino Karabeg

Dino Karabeg (1954) began his career as a researcher in environmental system modeling at Ruđer Bošković Institute, Zagreb. Following a doctorate in algorithm theory at the University of California at San Diego, and several university appointments in USA and France, in 1992 Karabeg accepted an Associate Professor position at the University of Oslo Informatics Department and moved to Norway. Soon after his interest shifted to systemic innovation in knowledge work, as he grew convinced that knowledge work can and needs to be developed on different premises, not as an attempt to objectively depict reality, but as it might help people and society orient themselves in a complex reality. From that point on Karabeg devoted his career to developing what he saw as various building blocks and contours of a new – purpose-oriented, and self-organizing – approach to knowledge.

Alexander Laszlo

Alexander Laszlo (1964) is an American systems scientist known as co-founder and President of Syntony Quest and former Director of the Doctoral Program in Management at the Graduate School of Business Administration & Leadership (EGADE-ITESM), Mexico. He is also President Emeritus of the International Society for the systems Sciences. He currently serves as core faculty for the Organizational Systems Renewal program at Bainbridge Graduate Institute in Seattle, Washington.

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I C 1
Corporate social responsibility: multilevel foundations towards a new holistic framework of CSR and a new concept of economic value

Chairs

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The actual body of knowledge about CSR considers it at 3 different levels: Institutional, Organizational and Individual [Aguinis & Glavas, 2012 JOM, 38(4): 932-968)] These different systemic levels call for an holistic view allowing to integrate these different perspectives in an organic framework. The aim of the symposium is to point out and incorporate the different levels of CSR and to shed the light on the systemic relationships linking the firm and its context towards a new, different and wider definition of CSR. This new approach may bring to a new and wider concept of value creation overcoming the limits of the classical economic theory based on financial capital and profit that are at the basis of the actual economic and social world crisis.

List of Contributors

Stefan Hielscher, Carlo Muth, Matthias Will: Mental models of corporate sustainability in business practice: evidence from the German consumer goods industry
Ursula Kopp: Systemic constellations: a new tool to educate managers in corporate social responsibility
Helge Löbler: Service for sustainability: a holistic approach
Norma Schoenherr, André Martinuzzi: Corporate impact assessment: a meta-analysis of existing tools from a systems thinking perspective
Mauro Sciarelli, Mario Tani, Ornella Papaluca: The relationship between CSR and strategy: a multiple case study in the coffee industry
Giovanni Paolo Sellitto: Â 'value for money': tracking the concept change through EU public procurement directives

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Mental models of corporate sustainability in business practice: evidence from the German consumer goods industry

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Abstract: This paper examines the prevailing criticism of the win-win paradigm of corporate sustainability both on a conceptual and an empirical basis. Our analysis has two major results: First, following the “ordonomic” approach we conclude that the criticism is conceptually misleading because a proper win-win approach uses sustainability trade-offs to actively re-frame corporate value creation value creation through innovation. Second, our empirical analysis shows that most companies of the German consumer goods industry follow indeed such a “pro-active”, innovation-based win-win approach to corporate sustainability.

Keywords: sustainability; sustainability management; ordonomics, qualitative research; GABEK®

Acknowledgement: Author contributions: S.H. and M.G.W. designed research; C.M. analyzed data; and S.H. wrote the abstract. The authors declare no conflict of interest. Budget resources of the Martin-Luther-University Halle-Wittenberg financed this independent empirical research.

1 Mental models in corporate sustainability

Corporate sustainability is far more than a passing fashion trend. In fact, most part of the literature acknowledges corporate sustainability as a functional part of value creation and views its activities as a strategy to create win-win solutions by combining both the business interests of profit-seeking and the broader interests of social development (Porter and Kramer, 2011).

1.1 Criticism of the win-win paradigm

Yet, this win-win paradigm also provokes fundamental criticism. Critics such as Hahn et al. (2010; p. 219) believe that this paradigm leads astray because corporate strategy based on win-win would blind out conflicts of sustainability and would constrain day-to-day business to ‘quick-win’ activities that already exhibit obvious win-win features. This would encourage companies, the authors continue their criticism, to leave many sustainability issues untouched which would require urgent attention by business firms, including primarily environmental or social issues that do not hold the prospect of quick returns on investment.

1.2 Win-win “Proper”: corporate sustainability as innovation management

Following the “ordonomic” approach to corporate sustainability as outlined by Beckmann, Hielscher and Pies (2014), we argue in this paper that Hahn et al.’s (2010) criticism is fundamentally flawed because it rests on a misunderstanding of the win-win concept. According to our perception, a win-win approach to corporate sustainability does not consist of picking the ‘low hanging fruits’ *only* such as criticized by Hahn et al. (2010). A constructive win-win approach rather takes seeming conflicts as the very starting point of corporate sustainability and tries to overcome trade-offs by rethinking and reengineering the whole process of value creation through product or process innovation (on the process of change management of organizational processes cf. Will, forthcoming). While this approach to corporate sustainability does not exclude taking advantage of ‘low hanging fruits’, too, it primarily focuses its efforts on integrating corporate sustainability in innovation management or vice versa (Hielscher and Vennemann 2013).

2 Corporate sustainability in practice: empirical evidence from the consumer goods industry

The empirical analysis of this paper aims at the relevance of such a “pro-active” win-win concept in business practices. To achieve this, we conducted a qualitative-empirical research to analyze the concept of corporate sustainability in the German consumer goods industry.

2.1 Data

The analysis is based on CSR and sustainability passages in the annual reports of seven DAX-listed companies in the year 2012, including Adidas, Beiersdorf, BMW, Continental, Daimler, Henkel, Volkswagen. These text passages inform about sustainability strategies, implementation and effects of selected activities. Although intentionally drafted, we believe that the corresponding documents also include the very heart of each company's corporate sustainability concept—potentially also part of the "mental models" and the "shared vision" (Senge, 1990)—that the top management tries to convey to its environment, particularly to shareholders and potential investors.

2.2 Method

Following the computer-based method „GABEK®“ (German: Ganzheitliche Bewältigung von Komplexität, English: holistic analysis of complexity, see Zelger, 2008) we conducted a content analysis of the seven German DAX-listed companies' annual reports (see also Hielscher, Vennemann and Will 2013). Based on the construction of association graphs (supporting the analysis and representation the mental models, see Buber and Kraler 2006), causality nets and a gestalten tree (supporting the analysis and representation of structures of meaning, see Mueller et al. 2011; p. 131), we are able to make a resilient statement on the concept of sustainability that the companies convey to the public.

2.3 Results

As a major result of this analysis, we see that most companies of the German consumer goods industry follow a "pro-active" win-win approach to corporate sustainability. According to our analysis, three findings support this conclusion: (i) most companies view corporate sustainability not primarily as a cost driver, but as a strategic competitive advantage; (ii) most firms interpret sustainability conflicts as an opportunity to reflect their standard routines of value creation and (iii) the sustainability activities of most corporations are strongly connected to innovation management and, most importantly, not only with regard to product innovations but also process innovations.

3 Conclusion: mental models matter

This project examines the prevailing criticism of the win-win paradigm of corporate sustainability both on a conceptual and an empirical basis. Our analysis has two major results: First, following the "ordonomic" approach we argue that the criticism is conceptually misleading because a proper win-win approach uses sustainability trade-offs to actively re-frame corporate value creation through innovation. Second, our empirical analysis shows that most companies of the German consumer goods industry follow indeed such a "pro-active", innovation-based win-win approach to corporate sustainability.

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Systemic constellations: a new tool to educate managers in corporate social responsibility

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Abstract: Exceeding dynamics of the economy and the rising awareness of Sustainable Development and Corporate Social Responsibility (CSR) increase the need for leaders to manage dynamic and multi-dimensional systems. The article discusses a method that can support leaders in grasping and understanding the complexity of social systems in order to make decisions based on comprehensive information and system knowledge: Systemic Constellations - a method already well established in organizational development and systemic consulting – is a highly useful method to help future leaders to understand the interrelations and interdependencies of system parts and members, to know and accept ambiguities and trade-offs of sustainability as well as the underlying values. Three distinct types of systemic constellations for the use in management education on CSR are presented and discussed.

Keywords: Corporate Social Responsibility; complexity; management education; systemic; constellation work; systemic constellations; systems approach

Acknowledgements: The author would like to thank Professor Georg Müller-Christ and Peter Kornfeind for valuable inputs and discussion.

1 Complexity of corporate social responsibility

Due to exceeding dynamics of the economy and the rising awareness of Sustainable Development and Corporate Social Responsibility (CSR) leaders and managers more and more need to manage dynamic and multi-dimensional systems.

1.1 Increasing Complexity and Dynamics

The complexity businesses are facing is growing tremendously, due to economic deviations, accelerated progress in technology and communication, aggregation of markets, increasing awareness of social and environmental values, etc. To meet those challenges the European Union requires *"smart, sustainable and inclusive growth"* (European Commission 2010). The economic crisis of the past years demands fast solutions.

The complexity of a system can be described by the interaction of its elements and is the number of different states a group of elements can show over time (Hayek, 1967). Both the number of such states (complexity) and the speed of change (dynamics) have increased lately, but our mental capacity to grasp those is limited (Bleicher, 2011).

1.2 Sustainability Management and CSR

In its beginnings, sustainability management focused on efficiency, later on market positioning, eco-marketing and stakeholder management. Currently, three approaches are being discussed (Müller-Christ/Hülsmann, 2003): Innovation decouples economic growth and resource input. The normative-social approach based on fairness and responsibility requires stronger regulations and more participation. Sustainability as rational approach aims at a long-term balance between supply and consumption of resources.

No matter which CSR approach it taken, changes are necessary in comparison to traditional business management, which was mostly focused on relatively short-term economic targets within a clearly defined scope: An enhancement of objective, temporal and spatial perspectives is necessary on the one hand and, on the other hand, stakeholders and social values have become more relevant for decision-making.

The traditional instruments of business management are not adequate any more, more systemic approaches and methods are required (e.g. Göllinger 2012; Hasenmüller 2013).

1.3 Deficiencies of current Systems Approaches

Corporate Social Responsibility challenges leaders as they are traditionally trained for "now-for-now" decisions, in order to contribute to profits. Sustainability requires "now-for-later-for-others" decision and the ability to understand and accept diverse parameters, ambiguities, and trade-offs (Müller-Christ, 2012). Another shortcoming of the traditional management practice is the work mainly within and not across department borders, providing partial solutions with selected, narrow management tools.

But, what is necessary is the knowledge about as many as system elements possible and their interrelations and interdependencies. Methods are needed that mirror power constellations, opinions, emotions and worldviews (Mingers, 2006, 218ff). Several mapping methods have been developed, mainly for strategic or change management. Even though those methods include signs and symbols, they stay two-dimensional, based on language and are rather time consuming.

No adequate methods are available for operational management. There and in management education a simple, fast method is needed, which can mirror complexity, focus on the respective problem/question and touches all senses in order to support systems learning.

2 Challenges for management education

2.1 Dealing with complexity as management task

The recent Communication of the European Commission (2011) again points out the social responsibility of businesses, especially for their impact. Managements are required to know about those impacts, which may create major difficulties and/or costs when trying to collect, filter and show this information (Martinuzzi et al., 2011). When applying Corporate Social Responsibility, in many cases values are the key filter criteria. Therefore managers need to know about those values and to be able to judge them accordingly.

Due to the increasing complexity and dynamics decisions would normally take longer, but in real life, the time available decreases (Bleicher, 2011), due to shorter innovation cycles and shorter working hours in generally. This results in permanent pressure for more process and project efficiency and for fast learning.

2.2 Systemic management education

Recent managerial approaches such as Sustainability Leadership and Responsible Leadership (e.g. Maak & Pless, 2006) show the new tasks leaders have to face: multi-dimensional and complex systems; diverse time horizons; ambiguities, conflicting stakeholder interests; and the needs to reflect on one’s own values and to constantly develop oneself on a personal level. Accordingly, leaders should have a deep understanding of sustainable development and grasp the impacts of their companies on all stakeholders including global and future impacts. Leaders are supposed to think systematically and holistically, respect different perspectives and take innovative and creative decisions on a long-term and responsible basis.

The challenge is to teach abilities that enable leaders to grasp the complexity of systems, to integrate different perspectives and unexpected developments, to distinguish weak and strong leverage points (Senge, 2006), thus leading to profound decisions, even if knowledge is incomplete (Malik, 2003, 63ff). So far there are not many concrete ideas of how to teach all this.

New methods need to be developed, such as experiential learning, action learning, peer longitudinal learning, peer assisted learning, and the like (Gitsham, 2012; Hind et al., 2009, 18; Maak & Ulrich, 2007, 474).

3 Systemic constellations help to understand complex systems

Systemic constellation work, originally developed as family constellations, was transferred to organizations and other systems (e.g. Grochowiak/Castella, 2002; Groth, 2004; Sparrer, 2000, 2006; Varga von Kibéd, 2000; Varga von Kibéd/Sparrer, 2002; Weber, 2000) in the 1990ies. It is now being used in a number of endeavors, such as consulting of enterprises, administration and policymaking, project management, coaching, etc. (e.g. Gminder, 2005; Kohlhauser/Assländer, 2005; Roevens, 2009; Huemann, 2013).

3.1 Systemic constellations – how it works

Systemic constellations aim at understanding the interrelations of parts of a system in order to be able to develop new solutions and to promote change. It is a spatial representation of the internal picture one has of the relationships, orders, hierarchies, dependencies and communication patterns of a system (Grochowiak & Castella, 2002, 19). This explicit and implicit knowledge is arranged in space, using either persons or figurines as representations of parts of the system (e.g. Roevens, 2009, 83).

Sparrer (2009:17ff) describes constellation work as a language of the whole system, which is more than the verbal and nonverbal communication of the single representatives within, but the communication between them, according to Schlötter (2005, 201) a kind of sign language. Thus, constellation work provides the information about a social system in analogue form as a picture. Such pictures are easy to understand and show deeply rooted structures and dynamics. IN addition to that, constellation work *"… offers an exterior view on a system and simultaneously encourages cognitive, emotional and affective learning, which facilitates the conception of complex system-correlations and CSR."* (Kopp & Martinuzzi, 2013, 213)

3.2 Three types of systemic constellations suggested to teach CSR

Derived from 10 years of experience with systemic constellation work both in sustainability projects (Galla et al., 2008) and teaching (Kopp & Martinuzzi, 2013), the author wants to elaborate on three distinct types of systemic constellations offering particular benefits for management education:

3.2.1 Systemic constellations of concrete problem situations

Systemic Constellation of a concrete problem situation would be very similar to constellations frequently used in consultations or business coaching. Someone wants to solve an organizational problem. A constellation is set up with the elements of the system under consideration, represented by persons or figurines. Thus the internal picture this person has of the situation is visualized and can be worked with. The advantage is that this type of constellation is close-to-reality. The disadvantage is the necessity to have the person with its case at hand, which is not always possible in teaching settings.

3.2.2 Systemic constellations of general situations

A general situation, for example, a company with its main departments, the customers, a social and an environmental NGO, is set up. With this type of constellation work, a general problem can be visualized and used in teaching very well. A slight disadvantage can be that is offers less connection to “real life”.

3.2.3 Systemic constellations of abstracta

Abstract concepts or system elements are represented in the constellation, for example, the economy and the responsibility, profits and CSR. Thus, general concepts can be discussed, but require a certain degree of abstract thinking by the participants.

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Service for sustainability: a holistic approach

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Abstract: The paper offers a new understanding of Service for Sustainability integrating service of nature, ecosystems service and human service (service made by humans). It argues that the phenomenon of service cannot be explained by human intentions or whishes as service is by far older than the existence of humans. To understand service four common denominators of service are identified and a Luhmanian Service Systems is described. The paper argues that consumption for its own sake is disorientation and that value does not come from consumption but from a transformation in the consuming/producing entity.

Keywords: Service of Nature, Ecosystem Service, Systems Theory, Sustainability, Luhmann

1 Introduction

Service is ubiquitous and a very common phenomenon in human coexistence and everybody has experienced service.

However service is not only a man made phenomenon it also exists in the natural world e.g. between organisms of low and high developed species. Firstly, service is addressed in the biology of symbiosis (Boucher, 1985, Douglas, 1994, 2010) not related to humans and secondly service is discussed in ecology (Boyd and Banzhaf 2007) where ecosystems (nature) offer service for humans. Research on symbiosis goes into the question why "different kinds of organisms help each other out" (Boucher 1985, p. 1) whereas ecosystems service research researches the service provided by nature for humans (Boyd and Banzhaf 2007). Service in nature is by far older than human made service as it already exits long before humans were on earth and without humans it still would be sustainable. Hence service as a general phenomenon can't be explained by human motives or intentions. What lies behind the existence of service? We will identify four common denominators of human and non-human service and describe a common frame of natural and human service that is based on a new understanding of the phenomenon of service. Integrating natural and man-made service enables humans to re-embed into nature without losing technological and cultural development. This paper is organized as follows (not all in this 4 page summary): Section 2 identifies realms of service in the man-made and non man-made word. Section 3 describes and identifies four common denominators of man-made and non man-made service. Section 4 uses Luhmann's system theory to identify the service system's single mode of operation which according to Luhmann defines the system and its environment (Luhmann 1995, 1996, 2006, 2008). Section 5 discusses academic and managerial challenges and implications.

2. Four realms of service

As shown in figure 1 four realms of service can be distinguished: Service exchanged between non human beings (nature to nature); service provides by nature to humans (e.g. ecosystem service) and service exchanged between humans and finally service from humans for nature.

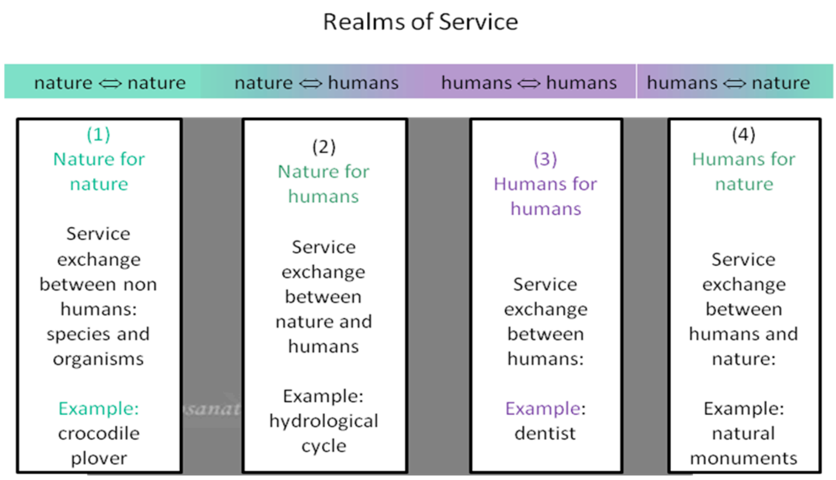


Figure 1: Realms of Service

The first realm of service contains all services exchanged by non humans; this service is provided by nature for nature and often discussed under the term symbiosis (Lewis 1985; Janzen 1985; Boucher 1985). Authors agree that in these kinds of interactions, “one of the species provide some kind of ‘service’ that its partner species cannot provide for itself” (Yamamura et al. 2004, p. 421).

The second realm of service is all service provided by nature for humans these are ecosystem services. Ecosystems provide less obvious service such as storm protection and pollination. Pollination of crops by bees is required for 15-30% of U.S. food production; most large-scale farmers import non-native honey bees to provide this service. (Kremen, 2005). “Ignoring these services in public and private decision making threatens our ways of living and impedes our ability to achieve our aspirations for the future.” (Ranganathan et al. 2008, p. 2). Humans benefit from a manifold of resources and processes that are offered by natural ecosystems. While environmentalists have discussed ecosystem services for decades, these services were popularized and their definitions formalized by the United Nations 2004 Millennium Ecosystem Assessment (MEA) (2005), a four-year study involving more than 1,300 scientists worldwide.

The third ream is not described here because it is the best known realm for humans.

The fourth realm is not only covering preservation of natural heritage. In Europe for example, already 40 percent of the bee colonies have disappeared. In China, there are only 10 percent left. Nevertheless, the Chinese take this threat for man and nature seem more serious than the Europeans. You have started trials for artificial pollination.

3 Common denominators of natural and human service

An extended review of different streams of literature served for identifying four joint denominators for human and non human service (e.g. Douglas, 2010 for Symbiosis; e.g. Boyd and Banzhaf 2007 for Ecosystems and e.g. Vargo & Lusch 2004, 2008 and Maglio & Spohrer 2008 for Human service):

1. Use or integration of resources. All service can only be performed by use of some kind of resource whether these resources are material (land, seeds, food, etc.) or immaterial (sunlight, information, wind, etc.).

2. Exchange/Transfer of resources. To get these resources an entity has to exchange them with other entities or with its environment.

3. Transformation (change) of the receiver’s state by use of resources. Resources are not integrated (used, consumed) for their own sake but for a change in a service receiver’s state whereby the receiver usually also changes (consumes or wear down) the resources.

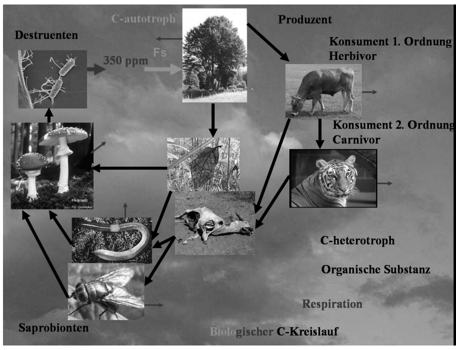
4. Contextuality of value (benefit) of service. Value or survival is not inherently a service characteristic. Value can emerge via resource integration depending on the relationship between service receiver and its environment hence value as well as survival is contextual. (e.g. Blaser and Atherton 2004 for Symbiosis; e.g. Turner & Daily; e.g. Chandler & Vargo 2011 for human service).

4. A Luhmannian service system

“Usually, systems are described through a plurality of terms. For example, systems are relations between elements; or a system is the relation of structure and process, a unit that directs itself structurally in and through its own processes. Here you have unit, boundary, process, structure, element, relation—a whole bunch of terms—and if you ask what the unity of all these terms is, you end up with the word ‘and’. A system then is an ‘andness’. Unity is provided by the ‘and’ but not by any one element, structure or relation.” (Luhmann 2006, 46). In a very condensed version describing a system and simultaneously avoiding “andness” we find three important properties of the system (Luhmann, 2006, 37):

- The system is the difference between system and environment
- A system can be defined through a single mode of operation
- Every system observes internally its own system/environment distinction

Applying this to service and referring to the common denominators a service system can be defined by the single mode of operation of an ongoing process of exchange and change of resources. Figure 2a shows the ongoing process of exchange and change in nature. Figure2b shows how the natural process is interrupted by humans “creating” waste where waste in this systems theoretical terminology can simply be understood as resources which cannot be integrated in the process of exchange and change (change in particular; and with this becoming part of the ongoing process) in a specific time frame.



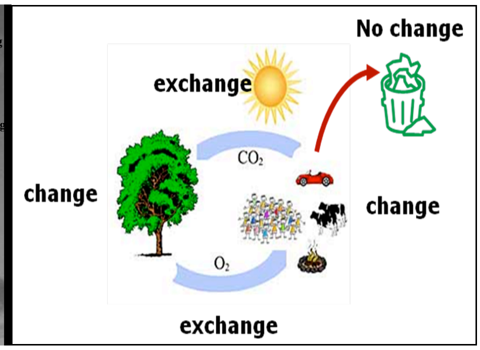


Figure 2a

Figure 2b

Since resources are not but become the service system is open to everything becoming resources in the service system however the system is closed with respect of the operational mode the ongoing process of exchange and change. By the process of exchange and change system and its environment are defined because the process of exchange and change needs entities performing exchange and change. However these entities are not part of the system but belong to the system’s environment and like the psychic system are the environment of the social system (Luhmann 1995, 1996). In addition for the service system the social and the psychic systems are environment. Figure 3 shows how the service system is integrated in Luhmann’s systems.

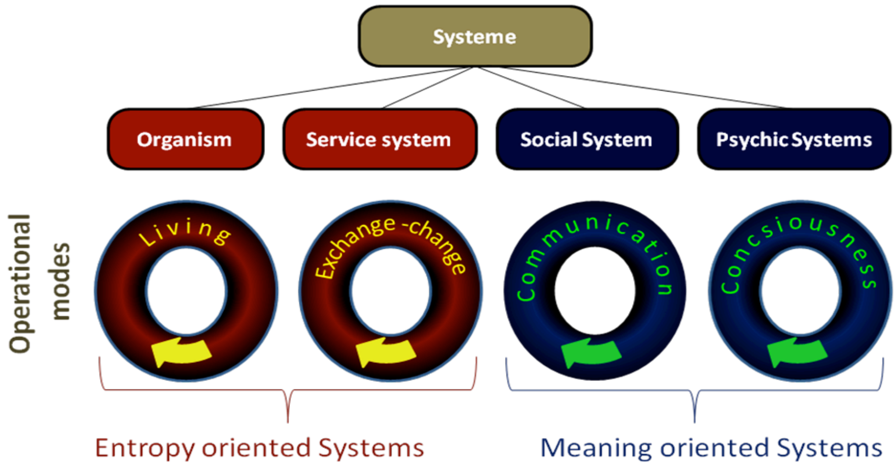


Figure 3.

What the social system is for the psychic system the service system is for the living system and for the social and psychic system. Whereas the social and the psychic system are meaning oriented the living and service system is entropy oriented. Both system are "entropy avoiding" systems. The service system as proposed here is explicitly bases on system theory and furthermore integrates exchange with change. It goes beyond the idea of input is output and output is input as it focuses on the whole process between input and output as well as between output and input. It also looks on value creating exchanges and changes as contextual.

Sustainability can be understood in this terminology as keeping the ongoing process of exchange and change uninterrupted in a specific time frame. As a first approach to specify the timeframe for resources to be changeable can be found by taking into account the life time of exchanging entities. A second approach to specify the timeframe for resources to be changeable can be seen in the growth rate of the amount of a specific resource in relation to its declining rate.

5. Implications

The above conceptualization of service as an ongoing process of exchange and change is – as typical for Luhmannian systems – a very abstract one. However it enables to integrate natural service and man-made service for a re-embedding of human service back into a general activity which is performed as well by nature and by humans. It further focuses beside exchange on the phenomenon between exchanges which is change. Economics and other disciplines (e.g. Marketing) have very elaborated understanding of exchange but a huge lack in understanding change as a second part of the coin of an ongoing process. Even consumer theory has not fully understood the process of change induced by consumption. It is important for politicians and managers to understand this under researched part of the ongoing process: changes between exchanges. Service in this sense is to avoid or to limit expiration by a change of resources which are exchanged.

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Corporate impact assessment: a meta-analysis of existing tools from a systems thinking perspective

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Abstract: Recently, scholars have started to move the debate on CSR away from a narrow corporate performance perspective and toward a more systemic view on corporate impacts. We posit that addressing the systemic relationships between companies and their impacts on the environments in which they operate requires impact assessment methods and tools apt to capture complex pathways of impact. In our presentation we will discuss the challenges and benefits of a systems thinking perspective in corporate impact assessment and discuss in how far existing assessment methods and tools consider systemic impacts.

Keywords: impact-oriented CSR, corporate impact assessment, pathways of impact, sustainability

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1 From corporate philanthropy toward impact-oriented CSR

The debate around the relationship between responsible business practices and competitive advantage has shaped the CSR research agenda for years. This focus on the search for the business case for CSR has somewhat overshadowed that the societal and environmental consequences of CSR still remain equivocal and under scrutinized. Only recently, scholars have started to move the debate away from a narrow corporate performance perspective and toward a more systemic view on corporate impacts (e.g. Epstein 2009; Porter and Kramer, 2011; Roome 2013). At the same time, a wide range of impact assessment methods and tools have been developed by consultancies, civil society and international organisations, as well as researchers. They address different issue areas, link up with different management approaches and are designed in different formats. If the CSR agenda is to genuinely address systemic relationships between companies and their impacts on the environments in which they operate, it is pertinent to understand in how far existing assessment tools capture complex pathways of impact.

2 Pathways of impact

Determining how companies cause impacts along these pathways is a challenging endeavour because of the high level of complexity involved (e.g. long and very diverse chains of effects), the lack of data (e.g. along value chains), and difficulties in determining causality and attribution (e.g. counterfactuals and contingencies) (Forss, Marra and Schwartz 2011).

Five pathways of impact engendering an increasing level of complexity can be distinguished:

1. Direct local impacts of business operations that are caused by production facilities, mines, plantations, or plants. These mostly relate to single unit impacts such as CO_2 emissions, which can be relatively easily measured.
2. Direct local impacts of community investments that are caused by donations, projects, or programmes not directly linked to the core business of a company.
3. Indirect local impacts are a "second round effect" of the first two pathways of impact. These pathways frequently lead to multiple-unit and multi-dimensional impacts, which can engender trade-offs, e.g. between economic and environmental concerns. Attribution of causality is a major challenge of measuring and managing indirect local impacts.
4. Supply chain impacts are caused by decisions of a company, but are observed at supplier and/or consumer level. The incidence of shared impacts involving several organisations or even networks is high, further enhancing attribution and causality difficulties.
5. Systemic impacts of corporate conduct are found on the societal level. They are realized through structural interdependences between actors and institutions, and can be transmitted through multiple feedback loops.

3 Assessment methods and tools

In this context, corporate impact assessment methods geared towards capturing systemic impacts need to address two main methodological issues. On the one hand, capturing complex impact pathways requires rigor in establishing causality and attributing different types of impacts across time and space. On the other hand, well-devised assessments need to weigh potential trade-offs and strategic priorities for managing impacts (Forss, Marra and Schwartz 2011; Douthwaite et al. 2003).

In the course of the EU funded project GLOBAL VALUE (www.GLOBAL-VALUE.eu) we evaluated and compared more than 30 methods and tools for corporate impact assessment. We distinguished the following types of tools:

- **Frameworks** offering instructions on how to carry out impact assessments, guidelines on how to analyze data, and indicator sets. *Examples: UNDP Company Level CSR Self-Assessment Tool, MFI Measuring Impact Framework Methodology, Iooi-Method.,.*
- **Online tools** comprising pre-assembled questionnaires and indicator-lists, as well as multipliers based on national or sectoral data. *Examples: Global Compact Self-Assessment Tool, HRIAM Guide to Human Rights Impact Assessment, GIIRS,..*
- **Country and sector profiles** tailored to one specific purpose only, and frequently without an overarching framework. *Examples: OECD Better Life Iindex, SEAT, Global Integrity Report.*
- **Platforms** supporting business-to-business communication and mutual learning on environmental and social performance of suppliers and buyers, granting each other access to the respective data. *Examples: CSRware-SSC, SIM, Supplier Portal*
- **Experts** from civil society organisations or research guiding companies individually in carrying out impact assessments and supporting them in implementing improvements. *Examples: Oxfam Poverty Footprint, PPI Progress out of Poverty Index (PPI Certificate), SAM Corporate Sustainability Assessment*

In our presentation we will discuss the challenges and benefits of a systems thinking perspective in corporate impact assessment and discuss in how far existing assessment methods and tools consider systemic impacts. Based on these findings we will derive research needs with a view to opening up the debate on impact-oriented CSR.

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The relationship between CSR and strategy: a multiple case study in coffee industry

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Abstract: Corporations can be seen as actors in a complex system of relationships that should be managed in order to create value. Using a broad perspective scholars define value creation processes as those processes that succeeded in aligning the economic performance of the corporation to the social effects its activities have. Corporation should strive to become socially responsible going beyond the economic perspective to acknowledge all the three pillars of sustainability. Corporations can have two main approaches to align their strategy to a socially responsible behavior. On one side they can exploit it to get a market advantage (strategic approach) or to acknowledge the lack of separation between economic and social activities. In this paper we use a Multiple Case Study on coffee brands to investigate how their *strategic approach* and the *ethical certifications* they have labeled their products with can help explain the role of CSR in corporation strategies..

Keywords: Corporate Social Responsibility, Stakeholder Management, Strategy, Fair Trade, Ethivsl Labels

1 Literature Review

Today enterprises are seen as actors embedded in a complex system of relationships linking them with their environment (Maak, 2007). This very same set of ties is at the center of the concept Corporate Social Responsibility as a way to acknowledge that enterprises should be held accountable for the impacts their actions have on several parts of the society (Simon, 1945; Bowen, 1953, Carroll, 1979).

In this way the performance of the enterprise goes beyond the mere financial ones to change into a multi-dimensional concept (Wood, 2010). Using this lens corporation can become fully sustainable as trying to be successful not only at the economic level but in succeeding not to overexploit the resources they need using a social and an environmental perspective too (Elkington, 1992; Passet, 1994; Lethonen, 2004). Using this approach Corporations will not only be able to reduce environmental impacts but they'll be able to increase the awareness of other social actors on these topics as well.

According to Font and Harris (2004), in order to highlight their commitment to sustainability Corporations can ask other parties to evaluate them, or just some of their products, in order to assess if they are eligible to get labels and marks for being socially responsible. In the most advanced cases these certifications can be granted only when the corporation limit itself to create partnerships only with those other players that share the same certification or, in a lesser way, only to those players that are explicitly linked to the very same issues. But sustainability labels and certifications are just voluntary tools, and organizations can choose to use them even only to enhance their own image (Miles and Munilla, 2004). While regarding impacts of the enterprise on the environment there are widely accepted standard as ISO 14000 or EMAS, for the social perspective there are several, and sometimes conflicting, standards. According to some authors (Farnworth, 2003, Font and Harris, 2004) social standards are often a combination of three main indicators: fair trade prices paid to the producer, quality of life for the producer, and contribution to the quality of life of the local community.

Several authors (Frederick, 1994; Carroll and Bucholtz, 2003) highlighted the need for Corporate Social Responsibility scholars to focus on how corporations decided to answer to external pressures to be more respectful of the society as whole.

Those actors that influence, or are influenced, by the corporation activities are usually referred to as "stakeholders" (Freeman, 1984: 46). And to manage stakeholders means to deal with the moral complexity resulting from answering to the claims of several stakeholders while building enduring and mutually beneficial relationships with most, if not all, of them (Maak, 2007).

Thus Corporation activities can become the sources of a real sustainable development process only when it do succeed in managing relationship with its own stakeholders aligning all the various interests in a single strategy (Steurer, et al., 2005).

We can classify the research streams on the relationship between Corporate Social Responsibility and strategy in two main approaches (Goodpaster, 1991): the strategic approach and the multifiduciary one.

According to the first approach, organizations can use a Socially Responsible behavior to attain two different objectives: on one side they can try to build upon the greater attention modern customers have on social responsible behaviors to create a sustainable competitive advantage based upon a differentiation strategy (Porter and Kramer, 2006; Carroll and

Shabana, 2010) or to avoid the negative effects related to potential retaliations from the other social actors as a consequence of an irresponsible behavior (Davis, 1973).
Instead managers do use the second approach when they see the separation of the economic performance from the social one as a fake one, and one that is doomed to crumble in pieces in the long run (they refer to this concept as the separation fallacy)(see Freeman, et al., 2010).
According to these authors enterprises have to be managed so to create the greater good for every class of stakeholders without incurring in trade-offs between their interests (Freeman, 1984).
This approach to strategy definition is usually called Stakeholder Management Theory (Freeman, 1984) and it allows that when managers succeed in acknowledging stakeholders relevance in their strategic decision making processes the relationships between a given organization and the other social actors in its own environment becomes the basis for a multifiduciary perspective on the effects the enterprise's actions has on the society as a whole leading to a better, and more sustainable, strategy.
This second approach asks managers to factor external pressures in their strategies using a two-steps process starting with a phase of stakeholder analysis, used to identify the salient stakeholders (Mitchell, Agle and Wood; 1997) and to understand the effects enterprise's activities have on them, and a second one of stakeholder synthesis used to shape the strategies according to the stakeholder needs and the managerial goals.
According to this theoretical framework we have designed our research in order to look on the deep relationship between Corporate Social Responsibility and Corporate Strategy. In particular we are trying to understand how the relationship between these two themes changes when ethics, and ethical products as well, are more central in the managerial action.

2 Research Design

Our empirical analysis is carried on using a Multiple Case Study methodology (Yin, 1994).
The cases we have selected come from a single industry as we wanted to limit the variation between them only to their strategic approach and which of their products have got an ethical certification.
We do evaluate if these enterprises are actively using these certifications in their strategies, and how they exploit them in their communication. Furthermore we analyze the other activities they are carrying on to increase stakeholder engagement in local markets and abroad as well.
In particular we have chosen to focus this empirical work on the importers of coffee. as we know that players in this interesting characteristics do share several interesting characteristics that make them good candidates for a qualitative study on the topics this paper is centered on.
Above all coffee is considered as the main "colonial" commodity and it is surely one of the main products internationally traded in the world (Catturani, Nocella, Romano and Stefani, 2008). As a matter of fact (International Coffee Organization, 2012) more than 90% of world coffee production takes place in a southern world country (f.e. Brazilian coffee growers cover more than one third of the whole world coffee production (33.71%) and Vietnam is a far second (18.86%)) while this commodity is mainly consumed in the developed world (U.S.A. is the biggest importer (24.2%), Germany is the second one (19.72%) while Italy is the third one (7.92%)). This characteristic is central in our research as the activities by these

corporations are not limited to a single social environment and, moreover, the geographical separation between producer and customer can help these enterprise in hiding an irresponsible behavior reducing their fear to face the Iron Law of Responsibility (Davis, 1973).

On the other side the limited effects these international trades have had on starting sustainable development processes in Southern World countries and the profound chasm between prices at the production, flowing to the Southern World's growers, and those paid by customers has driven some NGOs to create labels and marks to certify how much ethical are their procurement processes (Perna, 1998).

Moreover Pauli (2010) shows that the coffee industry has several innovation opportunities that could both increase its average profitability and reduce its environmental impacts reducing wastes linked to coffee production.

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"Value for money": tracking the concept change through EU Public Procurement Directives.

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Abstract: The semantic extension of "value for money" is slowly changing as new evaluation factors are taken into consideration, both in the civil society and in the context of Public Procurement.

On 15 January, 2014 the European Parliament approved three new Directives on public procurement, explicitly aimed at pursuing the best 'value for money' and *"contributing to the implementation of the Europe 2020 strategy objectives for a greener, more social, innovative and inclusive economy"*.

Looking back to the regulatory framework at the end of the last century and comparing the operational criteria to obtain the best "value for money" in the subsequent version of the EU Directives we discover that the meaning of "best value for taxpayer's money" has shifted from the cheapest offer for the good to be procured to the best quality/price ratio when taking into account factors as quality, efficiency, effectiveness and fitness for purpose, protection of the environment and social impact of the production process.

Keywords: value for money, sustainability, lifecycle costing, public procurement,

1 “Value for money”: tracking the concept change through EU Public Procurement Directives

On 15 January 2014 the European Parliament approved three new Directives on public procurement, superseding Directives 2004/17 EC and 2004/18 EC which dated back to 2004.

The explicit aim of these new rules on Public Procurement is to *“contribute to the implementation of the Europe 2020 strategy objectives for a greener, more social, innovative and inclusive economy”* and to pursue the best ‘**value for money’**.

The concept of value for money and its meaning in the societal imaginary is slowly changing and its evolution affects and is affected by where the boundaries of the products/services to be purchased are ideally placed. These boundaries are steadily expanding through space and time to include the whole product lifecycle - from its design up to the disposal - the carbon footprint, the social conditions of the laborers involved in the production process, the logistics. The world is becoming aware of neglected dimensions which characterize the objects and the services that we purchase, but our perception is still bound to old paradigms and our eyes hardly catch the invisible thread that links together the products, the environment and our lives.

As the boundaries of the products/services vary, they remodel the perception of the society itself as a complex system. The value of the product is no more limited to the static evaluation of how much and how cheaply it can fulfill some abstract need but it is complex and multi-faceted, since it involves the relations between the object itself and the environment where it is to be produced, used and disposed.

These changes in the perception of “value” at societal level are slowly pushing firms to adopt a new vision, considering the social and environmental externalities involved in their operations and going beyond purely economic considerations and strictly legal obligations when performing their business. The voluntary adoption and fulfillment of policies to mitigate the societal impact while doing business has gained the name of CSR, Corporate Social Responsibility and it is becoming a necessity more than a mere volunteering in today’s market.

The EU Public Procurement Directives can give us an insight on the changes that affected the concept of “value for money” during the last years, since they define the evaluation criteria to be adopted by the contracting authorities when they award a contract.

The concept of value for money is changing even in Public procurement. In the last ten years its meaning shifted from the cheapest offer, to the best ratio between price and quality up to the inclusion of the whole lifecycle into the concept of price and quality of the product/service to be procured. So the “best value” has expanded its boundaries to take into account factors such as quality, efficiency, effectiveness, fitness for purpose and the protection of the environment.

Let’s examine these Directives (the older ones, dating back to the past century, the 2004/28 EC and the newborn) in order to gain a deeper insight on the concepts of “value for money”, social responsibility and sustainability and the evolution of their meaning during the last decade.

The Directive 2004/18 EC in the whereas 1 considered the possibility to adopt award criteria linked to the subject-matter of the contract in order to meet the stakeholder's needs in the environmental and/or social area, as long as those criteria did not give unrestricted freedom of choice on the contracting authority.

The mention of this possibility as the first between the premises was perhaps originated by the the lack of any specific provision on the pursuit of social policy goals in the preceding Directives 92/50/EEC, 93/36/EEC, 93/37/EEC, which had caused many hassles to those Contracting Authorities which desired to take into account social considerations when awarding a contract. (see COM(2001) 566).

Nevertheless the approach adopted remained cautious, even if the need to adopt the so called "social considerations" in the award of public contracts had been pointed out in various communications and by various stakeholders before the publication of the 2004 Directive. CSR was to remain for some time something "to be adopted on a voluntary basis by the business".

The whereas 33 and 34 of the 2004/18 Directive catered for the introduction of social responsibility during contract performance (a phase regulated by civil law, and not in the scope of the directive itself) or the protection of the environment and the employment of people experiencing particular difficulty in achieving integration, but in the normative section we find only some succinct guidance (e.g. art. 19 "Reserved contracts" and art. 26 par. 6 on "eco-labels") and the Contracting Authorities were still left liable for their choices.

Between 2005 and 2007 many parties argued that contracting authorities could have mitigated somehow the limitations contained in the Directives considering that they were left a great degree of freedom about the object of procurement. This allowed the inclusion of environmental considerations (but only if these did not limit the access to the tender) and eventually the possibility of avoiding unnecessary purchases.

In 2008 the European Commission introduced a number of measures aimed at supporting GPP as part of the Sustainable Production and Consumption Action Plan.

In 2009 a communication was published about "The role of Fair Trade and nongovernmental trade-related sustainability assurance schemes" and in 2011 the Commission published a guideline on *Buying Social, A guide to taking account of social considerations in public procurement.*

The new 2014 directives, building upon all these experiences, raise the bar of Social Responsibility and shift from Green Public Procurement to Sustainable Public Procurement.

The concept of sustainability makes its appearance in the normative section of the new Directives, not only in the whereas introductory considerations.

One of the most innovative provision is the introduction of the concept of "life-cycle costing". The life-cycle cost includes both internal costs and costs imputed to environmental externalities (including the CO_2 footprint) and it covers the whole existence of a product/service, from raw material acquisition or generation of resources until disposal, clearance and finalization. The costs to be taken into account do not only include direct monetary expenses, but also external environmental costs if they can be monetized and verified.

Public bodies as buyers may refer to all factors directly linked to the production process in the technical specifications and in the award criteria, as long as they refer to aspects of the production process which are closely related to the specific production or provision of the good or service to be purchased.

This still excludes requirements not related to the process of producing the products, works or services covered by the procurement, such as general corporate social responsibility requirements covering the whole operation of the contractor.

So there is still space for a more inclusive concept of CSR and sustainability, but here the challenge is more social than theoretical: some business want to leave the application of CSR policies as a free choice, an act of liberality on their side and they leverage the concept of responsibility, clearly excluding any enforcement. The next move is then on the citizens: only becoming part of the process and building a social environment and a a just and sound scale of values can enforce the firms to adopt CSR policies as a condition to have their products viable. This is a question of social awareness and relies also on the balance of power between firms, corporations, citizens, administrations and policy makers, where citizens are themselves part of the more complex agents, adding complexity to the scenario.
Will the adoption of the Directives foster the adoption of the same approach on a wide basis also for the private procurement, leading to the introduction of a new societal approach to the product pricing? Currently many externalities are not taken into account in the price formation process, leading to a distorted organization (e.g. the logistics seems to be something cheap, while its environmental impact is sometimes devastating).
The availability of operational instruments to evaluate lifecycle cost will benefit also the private sector, *"contributing to the implementation of the Europe 2020 strategy objectives for a greener, more social, innovative and inclusive economy"* and to pursue the best '**value for money'**.

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I C 2
Social and environmental responsibility: balancing individual and collective actions (IASCYS Symposium)

Chairs

Pierre Bricage, University of Pau and Pays de l'Adour, Pau
Matjaz Mulej, University of Maribor
Francisco Parra-Luna, Universidad Complutense de Madrid

This symposium focuses on the most significant elements that have characterised the relationship between humans, natural ecosystems, anthroposystems, economic systems and societal systems. In this context, it is very important to know the systemic mechanisms that explain these relationships and their consequences. We can focus on the individual human being because at the end each action is the result of one people who decide to do it or not and how to do it. How is it that she/he achieves viability beyond survival in wild ecosystems, anthroposystems or economic systems that offers opportunities as well as challenges to their health, mobility, recreation, social communication, knowledge and so forth? But, this is not enough. We have to focus first on organisations and societies because they are individual actors who are influencing or constraining everyone to do or not to do and how to do. We need to pay attention to the impact/effect of all natural and societal evolutionary trends on individuals. It is the co-evolution of individuals and their systems that requires studying and action (education) to improve people's quality of life and to restore both a disrupted nature and all forms of ill-conceived social forms that we have created (for example dis-education by lobbying to make more money or to have more power). Indeed, it is possible to think in peoples' relationships with their eco-economic-systems, and to put the emphasis in the silent majorities and the challenges we all have in the co-evolution with our eco-economic-systems. How do we (individuals) engage with society and organisations to make them amplifiers of our individual concerns regarding our survival?

List of Contributors

Matjaz Mulej: Complexity of social responsibility
Susu Nousala: What could future learning structures look like and why would we care? The praxis of complex adaptive systems and learning structures

Francisco Parra-Luna: Why unemployment is so high in Spain: a look from an axiological systemic perspective
Xijin Tang: Approach to societal risk measurement by on-line community concerns

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Complexity of social responsibility

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Anita Hrast
Zdenka Ženko

Abstract: While Anita Hrast is economist and communicologist with specialization in social responsibility, Matjaž Mulej and Zdenka Ženka are economists with specialization in systems theory as a science on human attainment of requisite holism and in invention-innovation-diffusion processes as a science on implementation of novelties with benefit for their users. Hence we will focus on social responsibility as everyone's (new) responsibility for his/her influence on society on the basis of practicing interdependence as a precondition for requisite holism. Due to millennia of the human practice of one-sidedness and short-term criteria of behavior this is now unavoidable and a complex problem. Both interdependence and (requisite) holism are exposed by both systems theory and ISO 26000 on social responsibility. The – unfortunate and dangerous – situation in society is well clarified by the fact that ISO 26000 was passed only as an advisory rather than obligatory standard; this means that the social health is considered less important rather than crucial. On the basis of the research program which we have been performing as the IASCYS and the 'Scientific research center of IRDO', and the University of Maribor, Faculty of Economics, we will show how diverse can be contributions to the social health as one of the purposes of the socially responsible behavior of humans. We attracted about 500 authors from several ten countries as volunteers, mostly with contributions to nine IRDO conferences, but also to five our books for international publishers and three collections of articles in the top international journals on systems theory and cybernetics. 'ResearchGate' publishes data on interest of the international audience in authors; in texts by Matjaž Mulej, e.g. beyond 1.200 readers were interested in 2013.

Keywords: social responsibility, social/societal health, 'Scientific research center of IRDO', international cooperation, 'Social responsibility beyond neoliberalism and Charity', Bentham Scientific, 'Social Responsibility – measures and measurement', Systems practice and action research journal, 'Social responsibility – a new socio-economic order', Systems research and behavioral science journal, 'Social responsibility and holism in tourism', Kybernetes journal, Research Gate, complexity

1 Complexity of Social responsibility

1.1 The selected problem and viewpoint

Many data show that the current humanity is far from healthy (Hrast, Mulej, Kojc, editors, 2014). Health belongs to the most important values of humans at large: physical, mental, psychical, and social, in synergy. Obviously, humans with the strongest impact on the world-wide life reality often tend to prefer their own short-term and narrow-mindedly defined profits over the general human health. This global very dangerous fact may be seen as a complex crucial reason for United Nations, European Union, associations of progressive companies, International Standards Organization to pass their documents on social responsibility and consider social responsibility the way out from the current socio-economic crises. Many persons ask 'What do I have to do with social responsibility? What and how can I contribute? How can I benefit?' We wish to help them in this overview of our five recent books and three recent guest-edited journals, which the IRDO Scientific research center has generated in volunteering international cooperation, based on research by IASCYS and the 'Scientific research center of IRDO', and the University of Maribor, Faculty of Economics, chaired by Matjaž Mulej. We have no room here for details about the nine IRDO conferences (Hrast, Mulej, Kojc, 2013) and the IRDO commissioned research projects, which have also been crucial.

1.2 'Social responsibility beyond neoliberalism and charity'

This project started five years ago in the basis of invitation of the world-top publisher 'Bentham Science' located in USA, United Arabic Emirates and several more countries. It grew to four books with 33 chapters by 48 authors from 13 countries under editorship of Professors Matjaz Mulej and Robert Dyck; a foreword by Prof. Dr. Danilo Türk, former President of the Republic of Slovenia and former top official of United Nations is in all four books (over his entire period as President, the IRDO conferences and HORUS were under his auspices; Dr. Janez Drnovšek and Borut Pahor, president before and after him, had the same practice).

Volume 1 is titled: SOCIAL RESPONSIBILITY – A NON-TECHNOLOGICAL INNOVATION PROCESS. It contains four longer chapters, after a preface and a foreword:

1. Radical Innovation of Values, Culture, Ethics, and Norms Required for Social Responsibility; Matjaz Mulej and Robert G. Dyck
2. Human and Organizational Social Responsibility; Matjaz Mulej and Anita Hrast
3. Crisis? What Crisis? John Raven
4. Towards A New Economic Paradigm: The Parallel History of Economic Thought and the Way Forward; Gergely Toth

Volume 2 is titled: SOCIAL RESPONSIBILITY - RANGE OF PERSPECTIVES PER TOPICS AND COUNTRIES. It contains eight chapters, after a preface and a foreword:

1. Responsible corporate management and community involvement; Štefka Gorenak
2. Social responsibility and the rule of law; Breda Mulec
3. Well-being as the basic aim of social responsibility; Simona Šarotar Žižek

4. First responders in regional disasters: a case of social responsibility; Gerhard Chroust, Günther Ossimitz, Markus Roth, Nadine Sturm, Peter Ziehesberger
5. Requisite holism of behavior when facing complexity of pandemic diseases – new trends in Healthcare information system (HIS); Teodora Ivanuša, Matjaž Mulej, Iztok Podbregar, Bojan Rosi
6. Innovation of managerial attributes to incorporate a more systemic world-view; Matjaž Mulej, Tatiana A. Medvedeva, Vojko Potočan, Zdenka Ženko, Simona Šarotar Žižek, Anita Hrast, Tjaša Štrukelj
7. The economic and environmental decline of Atenquique, Mexico, associated with socially irresponsible corporate ownership; José G. Vargas-Hernández
8. Socially responsible business in the "BRICS" economies: the way to a sustainable future; Zhanna S. Belyaeva Alberto G. Canen

Volume 3 is titled: Social Responsibility -Sustainability, Education and Management. It contains 8 chapters, after a preface and a foreword:

1. Avoiding a Global Transport Crisis Following the Depletion of oil and Gas Supplies: A Crucial Case of Social Responsibility; John Kidd
2. The Role of Indicators and Scientific Research in the Sustainable Development of Croatia: An Overview; Emira Bečić and Jadranka Švarc
3. Social Responsibility Promotion by a Learning Region for Sustainable Development: A Case from Slovenia; Ana Vovk Korže and Mojca Kokot Krajnc
4. University Education on Sustainable Development as a Contribution to the Shared Responsibility of Experts and Knowledge-Based Society; Jan W. Dobrowolski
5. Performance Levels of Roma Pupils in Foreign Language Learning: Social Responsibility in School; Saša Jazbec, Branka Čagran and Alja Lipavic Oštir
6. Can Strategic Management Show the way out from the Current Crisis towards Social Responsibility? Tjaša Štrukelj
7. Family and Non-Family Enterprises: Differences in Core Values, Culture and Ethical Climate as Signs of Social Responsibility; Mojca Duh and Jernej Belak
8. Socially Responsible Management in Public Administration; Nina Tomazevic

Volume 4 is titled: SOCIAL RESPONSIBILITY - METHODS, DILEMMAS AND HOPES. It contains thirteen chapters, after a preface and foreword:

1. Support to Ethics of Interdependence and Holism by Edward de Bono's Methods of Thinking; Matjaz Mulej and Nastja Mulej
2. Capability of New Systems Theories to Help Escape the Crisis; Vesna Čančer and Matjaž Mulej
3. Trust Management by Computer Simulation: Towards a Fair, Responsible and Sustainable Economy; Denis Trček
4. A New Fractal Metric for Social Responsibility; Robert G. Dyck
5. The Syntax of Autocratic Systems and the Cybernetic Alternative of Systems Based on Social Responsibility; Matjaz Mulej, Kazimierz Turkiewicz, Domenika B. Turkiewicz
6. Use of System Theory Through Corporate Social Responsibility in the International Company Novartis and its Sandoz Generic Division; Matjaz Mulej and Siniša Petrović
7. More Social Responsibility by Learning Foreign Language and Culture: Case of Slovenian Pre-Primary Education; Mihaela Brumen, Branka Čagran and Fanika Fras Berro

8. Justice, Justness: How to ACT Right Pivot of the Ethics of Interdependence; Helmut K. Loeckenhoff
9. Implementation of Corporate Social Responsibility: Can we manage to Save Our World in Time? Grażyna O'Sullivan
10. New Economy and Social Responsibility; Robert G. Dyck
11. Self-Determination and Self-Esteem of Employees as Factors of Managers' and Employees' Social Responsibility; Simona Šarotar Žižek, Sonja Treven, Danica Svetec and Vesna Čančer
12. Requisite Personal Holism as a Basis of Social Responsibility; Simona Šarotar Žižek; Zdenka Ženko and Sonja Treven
13. Living Networks of Networks: The Societal and Environmental Responsibility of Humanity in the Fight between Humans and the Wild; Pierre Bricage

1.3 Social responsibility – a new socio-economic order

The Systems Research and Behavioral Science Journal published our collection of 15 articles electronically in 2014, too, while their publication on paper is foreseen in 2015:

1. Toward more social responsibility as a new – systemic – socio-economic order or disappearance of humankind; Matjaž Mulej, Anita Hrast, Robert Dyck
2. A Comparative Analysis of International CSR Standards as Enterprise Policy/Governance Innovation Guidelines; Petya Dankova, Milena Valeva, Tjaša Štrukelj
3. Social Responsibility and Citizen-Driven Innovation in Sustainably Mastering Global Socio-Economic Crises; Gerald Steiner, Filippina Risopoulos, Matjaz Mulej
4. Youth education for social responsibility; Robert Dyck
5. Management with a Frame of Mind for Systemic Thinking: A Conceptual Condition Setting Tool: Jean-Paul Ngana
6. Ethical Tax Corporate Governance of State-owned Enterprises; Lidija Hauptman, Jernej Belak
7. Restorative Practices: A systemic approach to support Social Responsibility; Markus van Alphen
8. Toward more Governmental Social Responsibility; the Case of Natural or Intentional Outbreaks of Highly Contagious Diseases; Teodora Ivanusa, Iztok Podbregar, Bojan Rosi
9. Educational Model for Promoting Creativity and Innovation in Primary Schools; Borut Likar, Franc Cankar, Blaž Zupan
10. Social Participation of High-School Students with special Needs – a case of promotion of systemic behaviour and social responsibility; Majda Schmidt, Edvard Protner, Branka Čagran
11. Social Responsibility, Human Resource Management and Organizational Performance; Borut Milfelner, Amna Potočnik, Simona Šarotar Žižek
12. A new socio-economic order: evidence about employees' values' influence on corporate social responsibility; Vojko Potocan, Zlatko Nedelko
13. Integrated Approach to Social Responsibility: a Model of Stakeholders Interaction in Russia and China; Zhanna Belyaeva, Alexander Kazakov
14. Eco-labels- and Schemes: A Requisitely Holistic Proof of Tourism's Social Responsibility? Sonja Sibila Lebe, Igor Vrečko
15. Transparency as a Precondition of Systemic Behavior: the Case of European retailing Banks regarding Social Responsibility Communication; Mirjana Pejić Bach; Mislav Omazić; Jovana Zoroja

1.4 Social Responsibility – measures and measurement

In Systems Practice and Action Research our guest-edited issue was published online in 2013. We focused on another viewpoint: 'Social Responsibility – measures and measurement'. In contains an Editorial and eleven contributions:

1. Editorial; Matjaz Mulej, Anita Hrast, Zdenka Zenko
2. Social Responsibility – Measures and Measurement as a Basis for Organizational Systemic Action; Zdenka Zenko, Anita Hrast, Matjaz Mulej
3. Transformation processes of the corporate development in Russia: social responsibility issues; Zhanna S. Belyaeva
4. The influence of employees' ethical behavior on enterprises' social responsibility; Vojko Potocan, Matjaz Mulej, Zlatko Nedelko
5. Measurement preconditions Systemic Action: the Case of Integral Low-Carbon Country and Sustainable Development Indicators: Emira Bečić, Darja Piciga, Anita Hrast
6. Corporate governance and the practice of business ethics in Slovenia; Jernej Belak
7. Critical self-evaluation – an Attribute of Systemic Behavior:
8. Authors of Natural Science Learning Materials as Evaluators; Branka Čagran, Milena Ivanuš Grmek
9. Measurement of employees subjective well-being as an aim of social responsibility; Simona Šarotar-Žižek, Borut Milfelner, Vesna Čančer
10. Project management supports (requisitely) holistic - socially responsible action in business systems; Igor Vrečko, Sonja Sibila Lebe
11. Competencies for mastering the crisis by corporate social responsibility; Gerald Steiner, Filippina Risopoulos, Matjaž Mulej
12. Social efficacy by responsible change management; Laura Pană

1.5 Social responsibility and holism in tourism

Guest-editors of an issue of Kybernetes, devoted to Social responsibility and holism in tourism, as the very first issue, too, on this topic were Ass. Prof. Sonja Sibila Lebe and Prof. Emer. DDr. Matjaž Mulej. Texts were submitted in February 2014 to be published later in 2014. They include:

1. CSR-based model for HRM in tourism and hospitality; Marija Rok, Matjaž Mulej
2. Systemic integration of holistic project- and hospitality management; Igor Vrečko, Sonja Sibila Lebe
3. Building a Model of Researching the Sustainable Entrepreneurship in the Tourism Sector; Katja Crnogaj, Barbara Bradač, Miroslav Rebernik, Doris Gomezelj
4. Holism and Social Responsibility for Tourism Enterprise Governance; Tjaša Štrukelj, Metod Šuligoj
5. Institutional context and hotel social responsibility; María Dolores Sánchez-Fernández, Alfonso Vargas-Sánchez, Paula Remoaldo
6. The Systems Approach to the Improvement of Innovation in Slovene Tourism; Marko Ropret, Tadeja Jere Lazanski, Borut Likar
7. Complex tourism systems: a visibility graph approach; Rodolfo Baggio
8. A Systems Thinking-based Grey Model for Sustainability Evaluation of Urban Tourism; Zheng-Xin Wang, Lingling Pei
9. Systems thinking and alternative business model for responsible tourist destination; Jelena Đurkin; Marko Perić

10. Early-Warning Management of Regional Tourism Emergency: A Holistic Approach; Xie Kefan, Liu Jia
11. Social responsibility, motivation and satisfaction: small hotels' guests perspective; Saša Zupan; Borut Milfelner
12. Towards 2.0 systems thinking: a cross-cultural study of sustainable tourism ads; Wided Batat; Sonja Prentović
13. Industry specific effects of CSR initiatives; hotels and airlines; Ana B. Casado-Díaz, Juan L. Nicolau, Felipe Ruiz-Moreno, Ricardo Sellers
14. Branding paradigms and the shift of methodological approaches to branding; Marica Mazurek
15. Social responsibility in tourism: System archetypes approach; Mirjana Pejić-Bach, Jovana Zoroja, Marjana Merkač-Skok
16. A New Method for Evaluating Tour Online Review Based on Grey 2-tuple Linguistic; Chuanmin Mi, Xiaofei Shan, Yuan Qiang, Stephanie Yosa, Ye Chen
17. Education for responsible persons, tourists and hosts through knowledge of neighbouring countries' languages in cross-border areas; Mihaela Brumen, Branka Čagran, Matjaž Mulej
18. Managing Knowledge Transfer Partnership for a rural Community: the Outcomes at Wirksworth; Peter Wiltshier, Michael Edwards
19. Systemic thinking for socially responsible innovations in social tourism for people with disabilities; Zdenka Ženko, Valentina Šardi

1.6 Dialectical Systems Thinking and The Law Of Requisite Holism Concerning Innovation

This book was published as the third volume in the series 'Exploring Unity through Diversity' by Assoc. Prof. Dr. Wolfgang Hofkirchner, Bertalanffy Center for the Study of Systems Science (BCSSS), Vienna, Austria. Its publisher was 'Emergent Publications', Litchfield Park, AZ, USA.

17.4 The Seven Principle Attributes of Systems Thinking Applied in this Book
17.5 Suggestion concerning Systems Education
17.5.1 Introduction
17.5.2 Basic Contents to be Covered in Teaching of Systemic Behavior
17.5.3 Some Conclusions

2. Concluding remarks

The essence of social responsibility is deeply in human attributes that are expressed with the seven principles in ISO 26000:

1. Accountability
2. Transparency
3. Ethical behavior
4. Respect for stakeholders
5. Respect for rule of law
6. Respect for international norms
7. Respect for human rights

And in two concepts from systems theory:

a) Interdependence
b) Holistic approach.

As the collected and analyzed data, which are above summarized in chapters and articles of our co-authors and our-selves report, nobody has any excuse to avoid these issues any time in any post and in any activity. Of course, our list is only indicative. We had no more room. What is briefed here is written on about 2.000 pages. The four books with Bentham are e-published, so are the journal issues, too. Social responsibility is a concept aimed to radically innovate human behavior for humankind to survive. It is a complex process, but extinction of humankind is much more complex. Bricage (2014) briefly expressed it: one eats or is eaten. Humankind keeps ruining its preconditions of survival and is eaten by the other nature, or innovates its behavior, most probably along with the motto of Australian Aborigines: 'To survive, we must be as hungry as the nature around us.' They survived millennia in deserts. Europeans and Americans, the most influential part of the current humanity, do not behave this way, but over-consume in the style 'Shop until you drop' and 'Greed is good' on the basis of very one-sided and short-term criteria of optimal behavior that abuses humans and other nature. The alternative is clear: social responsibility supportive of sustainability under the motto: 'Green is good' and 'Shop in the framework of your real needs without greed'. In other words: by systemic behavior under the label of social responsibility humankind can stop hating our children and grandchildren'. The lack of systemic, i.e. requisitely holistic behavior based on ethics of interdependence enabling interdisciplinary creative cooperation that has been practiced over the recent two centuries and especially after the 2nd world war, created a very high standard of living, but for 15% of humankind only, and on the basis of huge debts toward each other and the abused nature around us humans; it ruined the basis of survival. Social responsibility can recover it.

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Matjaz Mulej

Prof. Emer. Dr. Dr. Matjaz Mulej, 1941, retired from University of Maribor as professor of systems and innovation theory. He published +1.700 contributions in close to 50 countries and was visiting professor abroad for 15 semesters. He is a member of three international academies of science, including IASCYS (vice-president, in 2010-2012 president). Now he chairs the scientific research of IRDO Institute for development of social responsibility in Maribor; on behalf of it he co-edited ten books and issues of systems-sceince journals, published in 2013 and 1014 with about 500 authors from +30 countries. 'ResearcGate' reports that several thousand persons have demonstrated interest in his work.

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What could future learning structures look like and why would we care? The praxis of complex adaptive systems and learning structures

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Abstract: This work attempts to expose (for discussion) the praxis between learning systems and various types of community-based knowledge networked developments, including their positioning and connections within larger adaptive social networks. These engagements within the networks are mostly relative to issues of scale at which they operate, and can influence what can be achieved and sustained. The question of what a group does or how it behaves depends on the focus of the spectrum of knowledge based or action based communities. These groups range from informal and more sustainable communities of interest and practice based within hierarchy of organizational structures to the more self-determining independent, self-governing groups that have multiple determined goals. There is also the question of what impact does the longitudinal approach have and the relating learning cycles that take place for development of any community based effort, regardless of how well or loosely formulated. If it is necessary for these communities to develop learning and reflections then this paper argues that they be described as autopoietic systems that are comprised of many coupled cyclic processes or epicycles. This exploration will be framed as a discussion of current discourse and previously reviewed literature that looks at what elements need to exist in order for the emergence of robust communities or groups that can evolve, to remain relevant (Hall et al. 2012; Hall et al., 2005; Nousala and Hall 2008; Wenger and Snyder 2000).

Keywords: University, complexity of educational development, learning communities.

1 An observation of public discourse

Recently, Forbes published an article on the matter of leadership “The toughest leadership job of all (its not what you think)”. The author Rob Asghar (2013) made some very interesting and compelling arguments based on the experiences of a recent university president’s resignation from Wyoming. The discussion focused the qualities necessary to be successful in such a diverse and complex community, where interconnections and specialized relationships between entities really matter. Asghar lays out the argument for us quite clearly,

“…Eisenhower was one of America’s greatest leaders. But he had a very unremarkable run as president of Columbia University. It’s because he didn’t know how to navigate the hyper-intricate human maze that is a major university. The university president’s job is fantastically complex. Traditional companies open and shutter, and a founding CEO who fails can shrug it off and go on to start something new. But universities are expected to maintain high quality for centuries (consider how Oxford has kept churning for 8 centuries), while they’re also supposed to adapt to new developments (like online technology, globalization and so on). Give credit where credit is due: Apple’s a nice little enterprise, but Stanford will be thriving in 200 years, while Apple will be a historical footnote…” (Asghar 2013).

2 Observations of learning structures and their communities

Looking further into exactly what it takes for an institution of high learning to last as long as Oxford, might shine some light on some hidden or useful concepts. Managers cannot really rely on the same approach for multiple issues or problems. It takes experience over a length of time to develop a skill set that will have the depth and breath to understand a range of issues imbedded in corresponding environments. It takes a range of relevant approaches to bring about solution/s that may take a number of years (or generations) to unfold (Nousala et al 2009; Brown and Duguid and Brown 1991).

Robust organizations are based on healthy community dynamics, these university communities must have the depth and richness of a healthy “bio-diversity” that allows for constant adaptation and evolution. However, this also means that the governance of such an entity needs to be equally dynamic and adaptive, suggesting that strong relationships are needed between these perspective layers within organizations.

Famously, the Oxford and Cambridge or “Oxbridge” organizations have developed fairly unique approaches over time, which have their advantage based in resilience of a well-layered, in-depth of an old established community. The Oxbridge are mostly made up collages (there are other sorts of entities within the Oxbridge, but learning and research takes place predominantly within the collages) that are autonomous self-governing corporations within the universities and all staff belong to one of these. Within the colleges the interaction between disciplines have been well established providing more diversity. With this background in mind, the question as to what elements are necessary for the emergence of the modern version of the college and what it might look like, (including the many types of interactive groups and activities) maybe of interest to those developing new educational systems. The many types of educational variations that currently operate within the Oxbridge system are in a sense autonomous to a degree, but regularly display multi-layered interaction through governance, funding, research, projects and the like, which may also be a source of further investigation.

3 Discussion of a praxis – learning structures and communities

There are some hints as to why the autonomous component of the collages are critical but it mostly has to do with the scalability of individual and community effort, and here is the "crunch", at some point the boundaries become meaningless for individuals but useful for the organization. This really means that a critical balance must be struck between individual experience and organizational survival. This may seem obvious when its spelt out this way but the 21stC has it own unique issues to grapple with and organizations formed in this time don't have the same mindsets that once supported the Oxbridge formation, namely a longer term view of the significance or relevance of historical longevity (Hall et al. 2010a; 2010b: Nousala and Hall 2010: Nousala 2010: Salthe 1985, 1993: Simon 1973).

However, it seems that the group of college entities that form the greater Oxbridge have found some balance for the layers of community concerned, with some inner wisdom to match, namely the continuity of individual and group efforts that have continued for some 800 years or so. It just might be that the relevant aspects and insights of such an achievement might be worth considering (Nousala and Hall 2008: Hall et al 2012; Hall et al 2005).

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Why unemployment is so high in Spain?: a look from an axiological systemic perspective

Francisco Parra-Luna
IASCYS

Spain presents a very strange and unusual situation. For one side, Spain looks like a normal developed country (trains of high speed, removable energies, civil work, medical transplant of organs, sports…)… and the other, it presents an unusual level of unemployment (more than 25% of active population), what means almost three times the average of other comparables European countries (9%). And this acute difference is not new, it is rather an old well known pattern from decades ago. But these are the two extremes of the situation, because in terms of economic growth, public debt, public deficit, prices, rate of interest, etc. the differences are more or less near the average level. See f.i. the pages on "Economic and financial indicators" in the weekly The Economist , where the only indicator which is really outrageous, is the level of unemployment..

How such a level is possible in Spain?. Why can it happens?. And above all, why Spanish politicians and economists did not find a solution, while the Europeans arrived to it?. And why Spanish politicians and economists do not fill any kind of embarrassment in the face of such an stifling problem?

It would very interesting to deep into the psychological factors that could explain the origin of this attitude. But, to begin with, the Spanish global situation is not taken as an integrated "system of values" where economic variables are only one aspect of the system. Besides, it is well known that economic variables are determined, or strongly influenced, by social, psychological or political conditions. In other words, Spain is not seen by their politicians and economists as a complex system of interrelated "needs/values" where the ultimate end is to find the best possible balance between all these needs/values for the benefit of population.

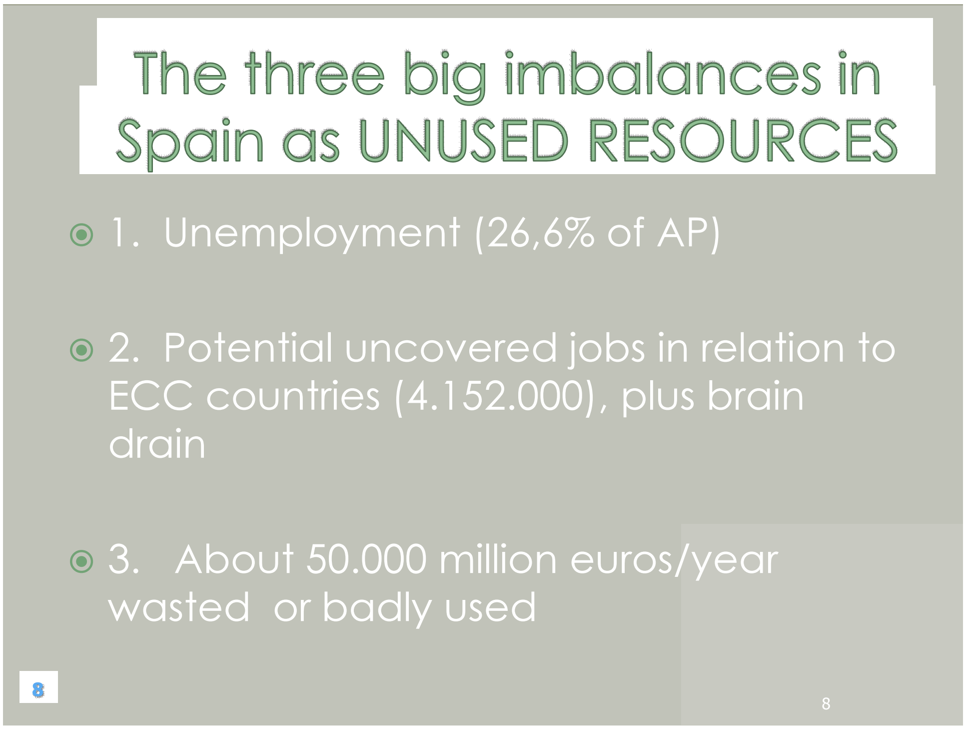
Due to this lack of axiological approach, which presents in my opinion a grave methodological weakness, the following four big mistakes are currently committing in Spain, by both political and economic authorities:

- To ignore that the economy is only a variable of the system of values to be performed, and it is not possible to understand and guide the Spanish economy without guiding before its whole system of values.
- Not to differentiate between the Spanish system of values and those of other countries in the European Union. But as the actual European Union is not still an integrated political system, the nations need different and specific measures which are not the general ones recommended by de European Commission.
- Not to establish a global quantified model of the Spanish economy. Usually numerous measures are adopted, but without calculating first the expected effects on the rest of the variables.

One of the causes of this inadequate methodology is to put into practice some theoretical approaches which are obsolete. These obsolete theoretical approaches are coming in a great extent from current economic teaching in most universities of the world.

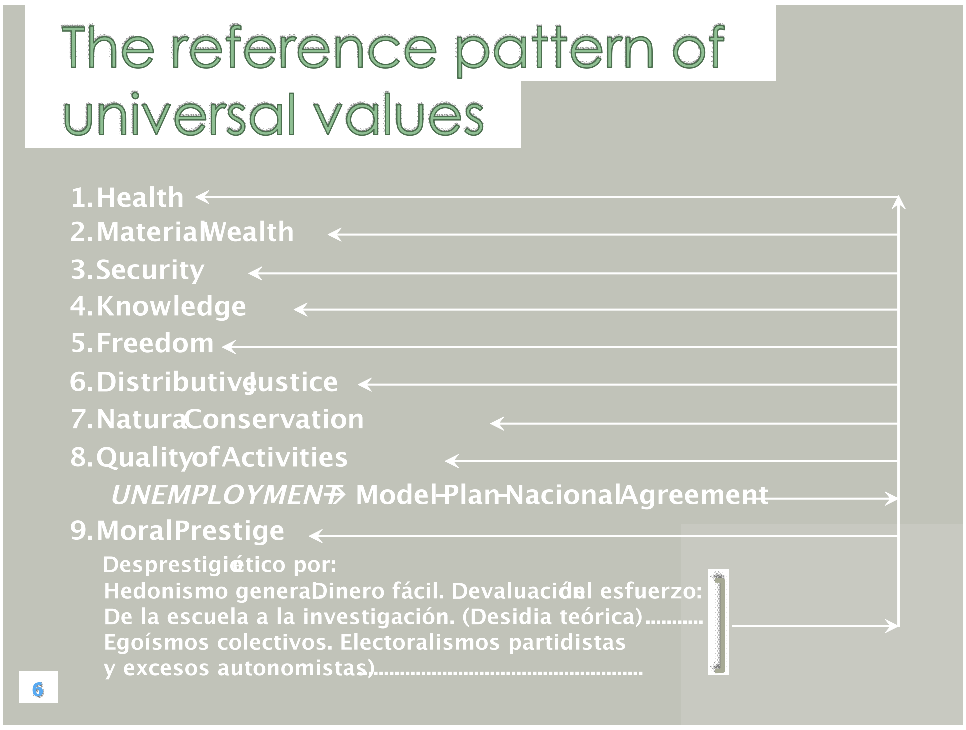
What could be done, then, in a country like Spain? First, not to forget that at the heart of all the political and social activities is the human being, that some millions of Spanish men and women have concrete needs to be satisfied and problems to be solved. But the main problem seems to be that governments do not look at the man in the street, but only to their political and personal interests in face of political opposition, or, in other words, Spanish politicians are more worried by the conservation of power, or how to hold as soon as possible political power, than in solving the real problems of people.

Would the unemployment problem has a solution in Spain?. Of course it would has , exactly in the same way that the problem has been solved in the other European countries, that is to say, combining and optimizing available resources with people`s needs . In principle three resources are available in Spain:



These three big imbalances in Spain as unused resources are: First, unemployment 26,6%; second, potential uncovered jobs in relation to ECC countries (at least 4,1millions), and third, about 50.000 million euros/year wasted or badly used.

The main problem to make operative this method is that it is necessary to adopt some kind of humanism in the political guiding of Spain, as, for instance, in the Axiological Systemic Model that will be resumed in this paper, which had to fulfill two essential principles: a) The human being has to be taken as the core of the model; and b) Therefore, it is necessary to know which are the basic universal NEEDS of human beings and their corresponding VALUES to be performed. The following REFFERENCE PATTERN OF VALUES would be necessary as a guide:



In the rest of the paper, I will try to apply these principles as a possible solution to the problem of unemployment in Spain.

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Approach to societal risk measurement by on-line community concerns

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Abstract: Societal stability has been heavily emphasized in current China for the top goal of the development of a harmonious society (Zheng & Tok, 2007). Then how to measure a harmonious society is also been studied from different perspectives in China (Bell & Mo, 2013; MacPherson & Cheng, 1996; Niu, 2011; Song, 1995; Wong & Shik, 2011; Zhu, 1993). A number of social indicators or relevant studies contribute to measure the societal state (Gelfand, et al. 2011; OCED, 2011). Tang (2013) made a simple summary of the typical indicators and commented some studies conducted by Chinese scholars. Most of those indicators require conducting time-consuming surveys on public attitudes and release the results annually. On the other hand, search queries, BBS posts and even microblogs reflect the community concerns timely and more truly especially in Web 2.0 era. A lot of studies have been taken to make use of search queries for flu trend prediction (Ginsberg, et al. 2009), blogs for measuring happiness (Dodds & Danforth, 2010), Twitter moods for stock market (Bollen, Mao & Zeng, 2011), etc. Here we explore to relate those hot search words, BBS posts or even microblogs with distinct societal risks using a category of societal risks constructed by Zheng, Shi & LI (2009). For example, we download hot news search from the new portal of the biggest Chinese search engines Baidu hourly by one crawler and generate one list of hot search news daily. We map each hot search news phase into one specific risk category or free-risk manually or by machine learning algorithms. Thus we acquire daily on-line Baidu news-related societal risk levels with the frequency of risk labeled hot search phases over the frequency of all hot search news words at that day. Similarly we can also get weekly or monthly risk level. Such an example shows one additional measure toward societal risk measurement. Illustrations with the latest data set of 2-year daily hot search news words will be given. More questions on either socio psychological or computing approach are worth discussed and studied.

Keywords: Harmonious society measurement; BBS posts; hot search phases, societal risk perception, on-line opinions

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Theme II
Emergence and design

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II A 1
Architectural ecologies: code, culture and technology at the convergence

Chairs

Liss C. Werner, DIA, Dessau Architecture Graduate School; Humboldt Universität zu Berlin; Tactile Architecture, Berlin
Andrea Rossi, Temporary Autonomous Architecture, Vienna
Lila PanahiKazemi, Temporary Autonomous Architecture, Hamburg

It is the basic characteristic of every organic system that it maintains itself in a state of perpetual change of its components. This we find at all levels of biological organisations. Bertalanffy, 1968 Architectural Ecologies: Code, Culture and Technology at the Convergence operates on the architectural interface between system theory, computation and biology, focusing on processes that are described as an alloy of technology, ecology and culture. The symposium opens a discussion on urbanity-systems, defined as coded, self-organising organisms structurally based on circular observation, feedback and learning, to a field of experts that can empower the discipline through a dynamic exchange within system theory. Since in C21 virtual and material reality merge and take on the form of code, architecture challenges the development of its own expertise at the understanding and description of structures as systems (living and non-living, virtual and material) in a spatial-temporal evolution. A critical understanding of this construct is required to enable the design of design strategies for apparent complexity. Therefore the debate targets the deep impact of system theory as culture, and simultaneously describes a frame for post- digital, namely biological, tools to become an element that allows for the understanding of urban and natural systems as a whole.

List of Contributors

Paolo Alborghetti, Alessio Erioli: The Red Queen hypothesis: chemotaxic stigmergic systems and embodied embedded cognition-based strategies in architectural design
Anna Barbara: Shapes of time
Henriette Bier, Seyedsina Mostafavi: Data-driven architectural production and operation
Ledian Bregasi, Renis Batalli: Self regulation as a tool for the management of the complexity in architecture
Ali Farzaneh: Evolutionary computation of architectural objects
Tim Ireland, Emmanouil Zaroukas: Actuating (auto)poiesis
Alexandros Kitriniaris: Neuronal ecosystems, towards an ecology of aesthetics
Alessandro Melis, PengFei Li: City retrofitting through cultivable envelopes

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The Red Queen Hypothesis: chemotaxic stigmergic systems and Embodied Embedded Cognition-based strategies in architectural design

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Abstract: The Red Queen Hypothesis is a research project on parasite architecture, developed as a case study application of knowledge inherited from the fields of stigmergy-based systems, swarm intelligence and Embodied Embedded Cognition. The project aims to provide a possible answer to the increasing demand for the redevelopment of abandoned post-WW2 buildings in northern Italy, proposing an alternative approach to the redevelopment of existing buildings (which is usually based on preservation logics) through intrusion, adaptation and growth. Implementing such approach in a non-superficial way entails the introduction in the computational design process access to increasing degrees of complexity and self-organization while keeping the whole process coherent throughout its unfolding and connect the subjects/systems involved.

The case study proposed is the abandoned ex-Ote factory in Bergamo, which has become an urban landmark for a socially intricate community: a multi-agent system based parasitism strategy has been implemented as design process for its transformation and reuse as spaces for community and cultural expression.

Parasitism is a non-mutual symbiotic relationship where a system (parasite) exploits resources from another system (host) in order to thrive and replicate; the original system is not destroyed and becomes an extension of the parasite system. Since the systems involved are very different in their structure and organization, the parasite "hacks" into the host system creating a communication interface that mimics the host's internal organization. Such interface has a very important role in establishing the communicative capacity and systems interactivity.

Keywords: Stigmergy; Multi-agent systems; architecture; computation; Parasitism.

Acknowledgement: The authors want to thank family for continuous moral support, classmates for providing constructive critics . Special thank goes to the open-source community, which helped during the development , sharing knowledge, technical support and free software distribution.

1 Simulation framework

Our simulation involves two parasites (simulated as stigmergy-based multi-agent systems) competing for the host's resources. The parasites-host interface that allows continuous data flow integration, tightly connecting the systems involved throughout the several phases of the design process, is implemented via an information substrate (a tensor voxel space) through which all the involved systems communicate. By building the design process upon these bases it is possible to coherently embed and correlate relational properties of agents, morphological generation, spatial negotiation and organization protocols, providing also coherent information for the fabrication phase (which is possible but not yet developed at this stage of the research).

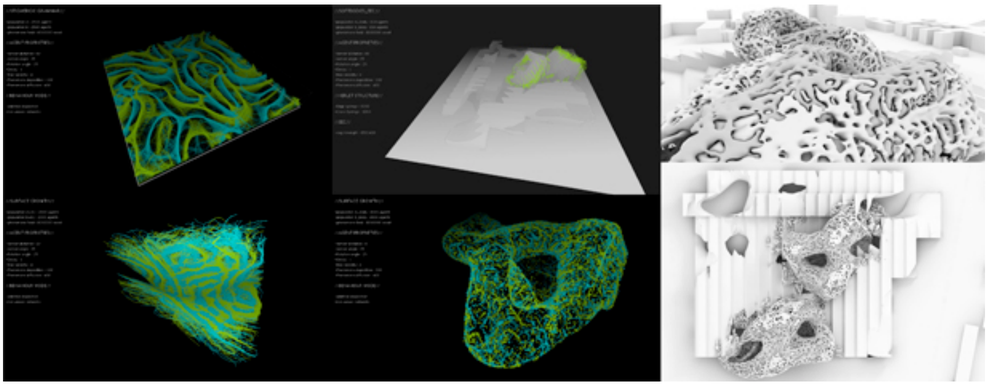
The Agents cognitive capacities to perceive the environment, which acts as common communicative substrate for data exchange and driving factor for adaptation through indirect coordination, have been exploited to investigate adaptive morphological configuration of semi-rigid bodies related to existing structures and systems.

Starting from the theoretical premises in Jones (2010), the classical multi-agent system model has been extended with chemotaxic stigmergy, the capacity of perceiving and react to chemical gradients of concentration. The environment has been modelled as a discreet 3-dimensional non-isotropic voxel field with chemical gradients encoded as tensor data in each voxel. The tensor model allows the embedding of multiple information layers such as solar radiation, stress and any other pervasive information the designer might consider relevant. Agents can selectively read and write data from the environment and change their behaviour accordingly: such continuous feedback loop allows for indirect coordination among agents system and intercommunication among different agent systems within the same environment.

Space negotiation, emergent pattern formation and performative properties have been explored through simulations of multiple populations of agents competing for resources.

Chemotaxic approach potential has been explored on a multiplicity of scales through a series of digital simulations ranging from volume morphogenesis to surface discretization.

These simulations are built upon a common framework, called stigmergic grammar, that involves 2 large agents populations, in order to better experiment emergent pattern formations and space negotiation. Each agent perceives pheromone deposition from its population mates, but eats pheromone from the other one; the pheromone field thus acts as communicative substrate for agents relationships (avoiding heavy neighbour search and proximity calculations). The multi-populated system grows along the Z axis, casting material and mutually avoiding trails networks on each loop. The 2.5D simulation was chosen as a simplified initial setup that allowed two important features: simulate growth over time and be applied to isovalues surfaces obtained from the voxel space.



Simulation samples : stigmergic grammar on surfaces, soft-bodies adaptation, volumetric growth, renderings

2 Design implementation

The stigmergic grammar has first been applied to the scale of the existing building. Initial information extracted from the site analysis such as main access points and possible flows through the area, were passed to the agent system in the form of spatial information data as inputs parameters and system constraints. A series of simulations have been performed (isosurfacing the density values field), producing a taxonomy of outputs, a catalogue of possible spatial configurations among which choose by means of space continuity and permeability criteria in order to feed next generation simulations. The designer exerts different levels of control over the bottom-up emergent process: although he/she does not impose the final outcome, he/she has the possibility to affect the self-organization capacity of the multi-agent system or channel it in pre-traced design paths (i.e. making it work on a designed morphology).

Still at the building scale, in the attempt of introducing features from Embodied Embedded Cognition theory (emergence of conscious and intelligent behaviour from the interaction of brain, body and world) for the exploration of adaptive morphological capacities, a further simulation step has been implemented by introducing softbody modules. Softbodies are adaptive morphologies built by instantiating agents over discrete spring-based mesh lattices (coded via Verlet integration), influenced (through gradients of spring stiffness and particle forces) by continuous agent pheromone interaction. Here data flows directly from agents' sensor-based perceptual system to body configuration; informed topologies produce shapes layouts that modify the information pattern, its distribution on the softbody itself and the environment, feeding back into the agent system until a stable configuration is reached.

The final configuration has been chosen after series of simulations on a wide range of mesh samples; those simulations evidenced that closed manifold meshes (deriving from genus 2 meshes), led to an interesting compromise between designer's control and systemic variation in terms of outcomes. Agents instanced on vertices are obliged to relate to agents/mesh vertices neighbour, avoiding mesh collapse (which was often happening with non-manifold meshes).

At a smaller scale, thanks to the development of a custom strategy for mapping 2D simulation to 3D topological space through undistorted projections, the surfaces intricate tectonics are the result of multiple populations of agents acting influenced by several parameters, including both inherited-endogenous (such as performative ones) and intentional (designer decisions).

Mesh vertices acted as tensor space, embedding different weight layers derived form solar radiation analysis and FEA structural stress analysis (both mapped as RGB values map). A third layer (again, there is potentially no limit to the number of information layers embedded) has been implemented to let the designer influence intentionally the growth process by painting mesh vertices weight. During each loop agents read the data directly from mesh vertices, and translate it into behavioural outcome (which include feeding back a change in the same data that was read). Proprieties and parameters of the agents cognitive system has been assigned to each weight layer, with the precise intent to do not control directly agents movements, but only influence their environment perception and consequently the way they translate perceived and embedded data into structured configurations, like spatial layouts, matter organization and structure formation.

Population of agents fight for space negotiation creating fibrous based material systems in two different ways: the first based on matter accumulation through additive deposition (compliant with contemporary additive manufacturing processes) and the second based on non-woven networks methodologies.

The purpose of the Red Queen Hypothesis is to investigate alternative proposals in the topic of building redevelopment through parasitism; in order to explore such strategy it is necessary to introduce in the computational design process access to increasing degrees of self-organization and potential emergent behaviour. Continuous data flow processing empowered by cognitive capacities of multi-agent systems that are influenced by body consciousness (which is also a pivotal argument for AI cognitive protocols) can provide such access with very promising potential that, although it needs further investigation, already delivers interesting outcomes on the aesthetic, tectonic and spatial levels.

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Paolo Alborghetti is an Architect and coder, graduated from Politecnico of Milano with a research thesis about swarm intelligence and cognitive protocols , His interests focus on simulations of non linear system in intensive environments, emergent and adaptive behaviors. Supporter of the open-source and open-knowledge community, he's deeply interested in creative coding as new communication medium. He collaborated with different studios in Italy and abroad, working as computational expert on large scale and complex shape projects, while he's been keeping on his personal research (http://radical-reaction-ad.blogspot.com). He's been teaching assistant at Politecnico of Milano and teaching tutor at different workshops about computational design and digital fabrication. He expresses his design sensibilities combining advanced mesh modeling (Maya, Blender, Softimage) ,parametric design (Rhinoceros / Grasshopper) and programming (Processing, C#, Python) .

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Architectural ecologies: code, cultures and technology at the convergence

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Abstract: The architects of the future will be more busy designing the shapes of the time instead of the forms of space. Is on time dimensions that are launched the new technological, semantic and cultural challenges. The geometry of Euclidean space are bent to the new imperatives of the many temporalities of the contemporary world.

Keywords: time, architecture, mobility, modality

1 Shapes of times

If we were to analyze systematically the parameters of today planning we would see that contemporary (and not contemporary) architects are more concerned in designing the forms of time rather than spatial ones.

Time-based space occupies the realms of invisibility and virtuality. Plus, it deals with the movements made by the dynamic observer that XX century had started to follow close.

When Gilles Deleuze imagined the foldings of space, he was foreshadowing what the new infrastructures of transport and information would have produced, relentlessly deforming the relationship between space and time.

The measure of mobility is rarely calculated in meters, and more frequently in seconds, hours, days. It is the time-based parameter that defines the price of a trip, more than the real spatial distance. Once the bodily experience of movement is lost, the time employed is what really counts.

Thus new geographies are drawn anew: the suburbs outside the cities sink in the folds of exclusion and distance, while city centers are ruled by other proximities, positioned along the same speed vector.

In this folded, sometimes only rumpled territory, the cardinal points allowing multiscale and intermodality are those hubs facilitating a shift of transport, speed and scale.

The media that can convert movement in mobility (i.e. the movement of the whole system, not of the single individual) become the protagonists of the updated planning of places.

It is therefore an extraordinary association of transports and media that allows to reach *synchronicity* and *ubiquity.*

Synchrony is one of the aims of the system. While all the points are dynamic, the space/time appointment is the only possibility of real encounter. The dynamic point encounters another one only and solely if it also meets its schedule

Ubiquity, which in old utopias we believed could be reach with powerful dematerialization machines, was instead obtained thru new media and their high-fidelity. These bring us to be omnipresent in different places and realities. Ubiquity is a radicalization of simultaneity and mobility without movement; in this case the most plural forms of time come to the forefront, rather than the individual forms.

Spazio e tempo sono le coordinate mentali del corpo in movimento, sono in fondo una stessa e unica cosa: perciò si parla di "spazio di tempo". (Carl Jung, 1976,)

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Data-driven architectural production and operation

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Abstract: Data-driven architectural production and operation as explored within Hyperbody rely heavily on system thinking implying that all parts of a system are to be understood in relation to each other. These relations are increasingly established bi-directionally so that data-driven architecture is not only produced (created or designed and fabricated) by digital means but also is incorporating digital, sensing-actuating mechanisms that enable real-time interaction with (natural and artificial) environments and users. Data-driven architectural production and operation exploit, in this context, the generative potential of process-oriented approaches wherein interactions between (human and non-human) agents and their (virtual and physical) environments have emergent properties that enable proliferation of hybrid architectural ecologies.

Keywords: Data-driven Design, Generative Systems, Design Information Modeling, and Emergent Design Processes

Acknowledgement: This paper has profited from the input and contribution of Digitally-driven Architecture - Hyperbody researcher and student teams.

1. Introduction

Benjamin[1] stated 1936 that mechanical reproduction has freed the work of art from its dependence on ritual, which implied inter al. a move from drawing towards photography and film. In an even more extreme process of emancipation, digital production implies inter al. that the work of art and architecture become digital addressing, therefore, principles[2] such as data-driven or computer numerically controlled representation, generation, production, and operation. Thus, as more recently convincingly argued by Carpo[3], the historical understanding of buildings as physically built identical replicas of architectural intent (formalized in design) which eventually in the 20th century became serially, mass produced identical copies, is challenged by the contemporary data-driven parametric multiplicity and variation. Such multiplicity and variation allowing versions of architectural intent to be virtually or physically implemented and experienced through inter al. spatial reconfiguration has been explored within Hyperbody (fig. 1) with the understanding that multiple versions of the built space may be achieved through kinetic transformation.

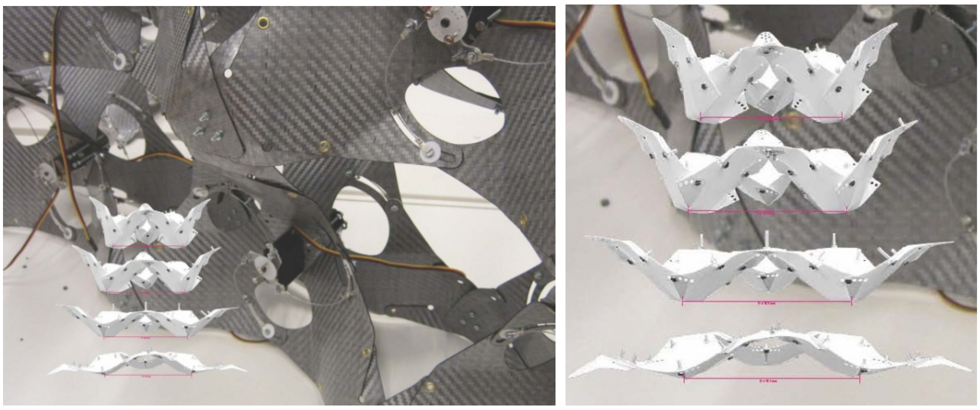

Figure 1: Physical change and variation explored within Hyperbody (2010)

Furthermore, experimentation with parametric multiplicity and variation has been addressed with focus on generative design and data-driven production, which were explored as tools to not only investigate an array of digital techniques but also critically reveal what these techniques may offer architectural production as well as outline what challenges remain in their application. The relationship between generative processes and data-driven production has been focus of current architectural research and practice largely due to the phenomenon of emergence explored inter al. within self-organization, which is defined as a process, in which the organization of a system emerges bottom-up[4] from the interaction of its components. Self-organizing swarms[5] for instance, are employed in generative design processes, which deal with ample amounts of data featuring sometime conflicting attributes and characteristics. Those attributes and characteristics are incorporated in behaviors according to which design components such as programmatic units swarm towards targeted

[1] W. Benjamin, The Work Of Art In The Age Of Mechanical Reproduction.

[2] L. Manovich, The Language of New Media. Cambridge: MIT Press.

[3] M. Carpo, The Alphabet and the Algorithm. Cambridge: MIT Press.

[4] M. De Landa, Deleuze and the Use of the Genetic Algorithm in Architecture, Rahim, A. (ed.), Architectural Design - Contemporary Techniques in Architecture, Academy Press.

[5] H. Bier, Building Relations, ed. by Bekkering (Rotterdam; Architectural Annual 2005-06: 010-Publishers), pp. 64-67.

spatial configurations[6]. In this context, architectural design becomes procedural instead of object-oriented and architectural form emerges in a process in which the interaction between all parts of the system generate the result. Thus, the architect becomes the designer of the process and only indirectly of the result.

2. Discussion

Swarms operate as multi-agent systems[7] consisting of simple agents that interact locally with one another and their environment based on simple rules leading to the emergence of complex, global behavior. Their use in design is of relevance because of their ability to embody both natural (human) and artificial (design related) aspects. Swarms are, basically, set up as parametric models incorporating characteristics and behaviors representing the natural and artificial systems themselves, whereas simulations of behaviors[8] show operation of such systems in time.

Intelligent (artificial) agents are conceived (in computer science) similarly to natural agents as autonomous entities able to perceive through sensors and act upon an environment using actuators[9]. Interactions between human and artificial agents may follow principles as described in the Actor–Network Theory (ANT) implying that material–semiotic networks are acting as a whole9 whereas the clusters of actors or agents involved in creating meaning are both material and semiotic. ANT, therefore, implies agency of both humans and non-humans, whereas agency is not located in one or the other, but in the heterogeneous associations between them.

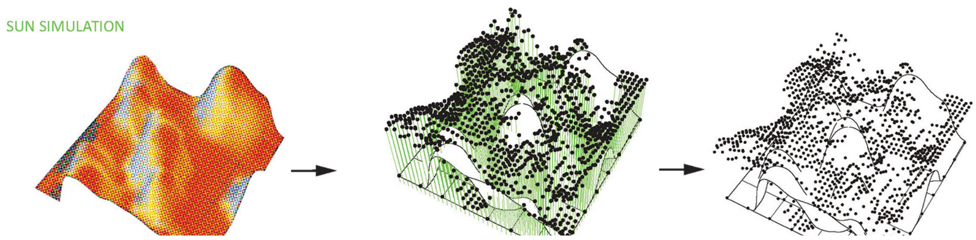

Figure 2: Generative design explorations developed with MSc 3 students by informing the point cloud with multiple simulations (in this case solar radiation for different seasons)

Such heterogeneous generative processes implemented in simulations are extensively discussed by De Landa[10] in relation to his interpretation of Deleuze's idea that form emerges from within matter itself, hence philosophy of immanence (not transcendence) in which matter itself has the capacity to generate form through immanent, material, morphogenetic processes. Simulations based on cellular automata and multi-agent systems are defined, in this context, as forms of knowledge visualization and means to conceptualize spaces emerging from local, bottom-up interactions.

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[6] H. Bier and T. Knight, Digitally-driven Architecture in H. Bier and T. Knight (eds.) 6th Footprint, Delft.

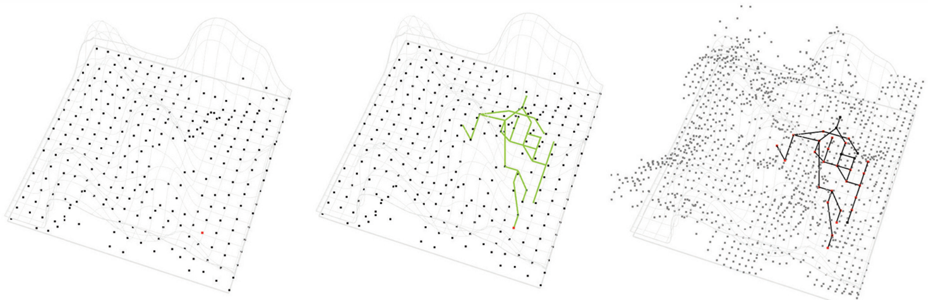
[7] Ibd.

[8] M. De Landa, ibd.

[9] B. Latour, Reassembling the Social: An Introduction to Actor-Network-Theory. Oxford University Press

[10] M. De Landa, Philosophy and Simulation: The Emergence of Synthetic Reason, Continuum Publishing Corporation.

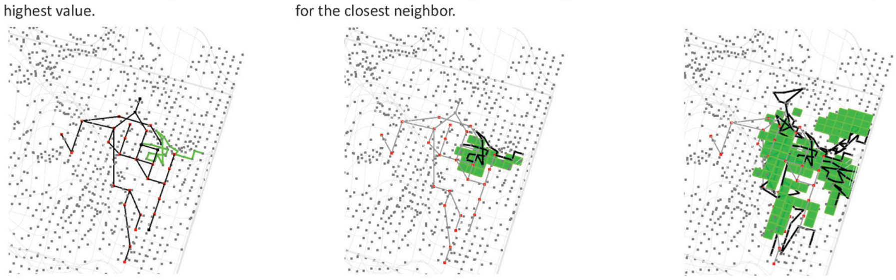
Simulation in relationship to architecture has been addressed within the Hyperbody studio with respect to its ability to support the generative development of architectural production: Data-driven production processes and their intrinsic connection to physical, mathematical, biological, etc. sciences increasingly enable architecture to surpass mere technological application in order to address, as argued by De Landa, system, population and topological thinking. While, system thinking implies that all parts of a system are to be understood in relation to each other[11], population[12] replaces typological thinking as it rejects the focus on representative types in order to emphasize individual variation, and topology[13] studies space and transformation.



1. Grid of points from wind simulation. Generative system starts with the point with the highest value.

2. Circulation system is grown as recursive branching based on the logic of searching for the closest neighbor.

3. Grid of the points from Sun simulation is added to the system.



4. System starts cluster branches from the point on the circulation with the highest sun radiation value.

5. Floor area pixels of 1x1m are added to each point of the cluster branch to create initial floor footprint of the pavilion.

6. System grows branches until the tota area of the floors equals 400m2.

Figure 3: Diagrammatic snapshots illustrating generative systems within the informed point cloud

In this context, the architect employs agents that produce architectural artifacts, thus architectural production becomes the result of multiple interacting natural (human) and artificial agents. Such agent-based processes imply that same or similar (virtual and physical) agent systems may produce under similar conditions multiple (or endless) variations of architectural artifacts due to the emergent properties of the system.

Such emergent design processes have been focus of MSc experimentation at Hyperbody with the aim to develop complex generative systems and incorporate them in performance-based design processes. These processes address two main aspects: Generative systems are based on and derived from different types of complex systems[14] and second a chained and holistic algorithm that would ease the processes of design information exchange[15] between different stages of parameterization, generation and simulation for performance measurement and evaluation. Different types of complex system are explored and

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[11] B. Wilson, Systems - Concepts, Methodologies and Applications, 2nd ed., Wiley.

[12] E. Mayr, E.: Darwin's Influence on Modern Thought, 1999 (retrieved 18-02-2013 from http://www.biologie.uni-hamburg.de/b-online/e36_2/darwin_influence.htm

[13] W. Sierpinski, General Topology, Dover Publications.

[14] J. Holland, Studying Complex Adaptive Systems, Jrl Syst Sci & Complexity 19: 1-8.

[15] S. Mostafavi, Performance Driven Design and Design Information Exchange. Computation and Performance, Faculty of Architecture, Delft University of Technology, Delft: eCAADe

customized based on the distinct design objectives and requirements considered in each of the projects. In other words, in these projects generative systems are defined as design mechanisms in which both synthesis and analysis sub-routines can be embedded and applied for a multidisciplinary performance-driven design. With this target, for the first step, initial studies were conducted exploring different complex systems[16] such as fractals, recursive systems, cellular automata, L-systems, and agent-based systems. By analyzing the behavior of each of these systems, on one hand the design teams were able to control the bottom-up emergence processes of complex systems and on the other hand change the behavior of these systems by introducing more conditionals or if-then structures in the scripts.

One project is representative and aims to integrate the data gathered from the site analysis from macro to micro scale in order to generate the design of a pavilion with emphasis on ecological and environmental aspects. At detail level, the focus was to achieve material and resource efficient design solutions through, informing the complex systems and integrating environmental and structural simulations in either chained sets of algorithms or holistic computational design systems.

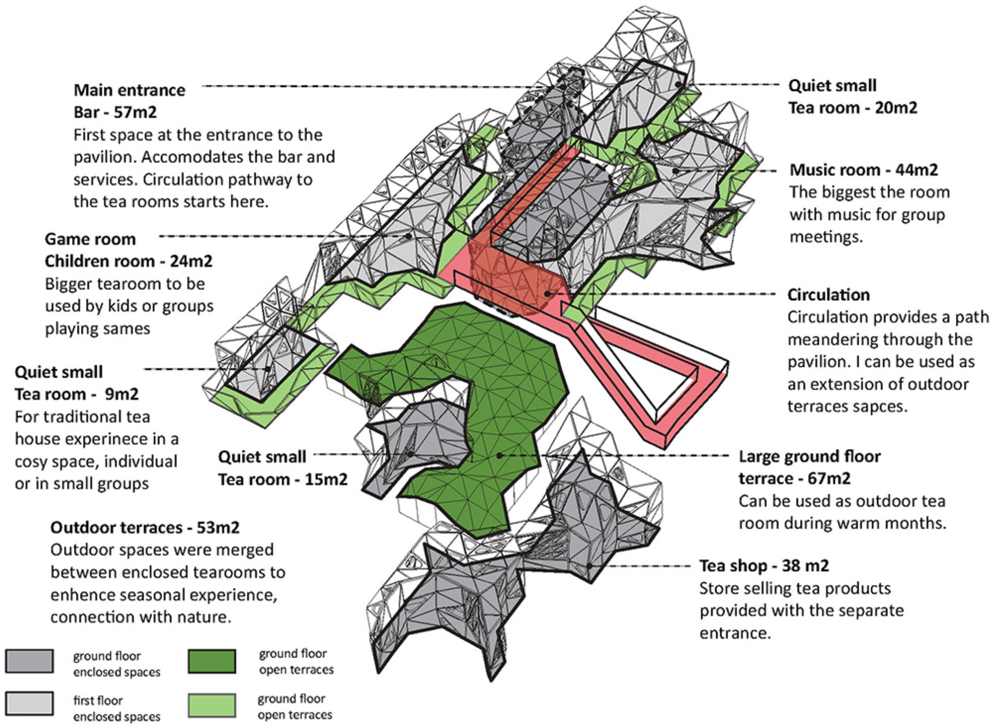

Figure 4: Diagram presenting one of the selected configurations of the Eco-locator pavilion

Eco-Locator (fig. 2-5) has developed a twofold climatic strategy focused on Computational Fluid Dynamics (CFD) for airflow simulation and solar radiation including daylight access simulations on site. The goal was to provide data sets that would inform the generative system. In this case, the generative system implies a recursive search evaluating site condition and generating rough configurations for the pavilion, its structure as well as its circulation system that will shape clusters for hosting the program.

The geometric logic of the recursive generative systems utilizes branching in order to allocate and search for the optimum floor plan arrangements considering wind and sunlight

[16] A. B. Downey, Think Complexity, Needham, Massachusetts: Green Tea Press.

qualities of the site. Since CFD simulations are dynamic, a strategy was established to transfer relevant data, from Autodesk Project Vasari, to Rhino through Grasshopper. The strategy consisted of implementing multiple simulations as for instance simulations for dominant seasonal conditions and employ color-coded mapping to inform the point-cloud. At the same time, solar-radiation evaluation was conducted and the results were associated with the grid of points populating the site, giving each point within the point-cloud, a multi-dimensional data-structure comprising different environmental values.

The first implementation of the branching system on the informed point-cloud produced the circulation scheme of the pavilion and secondary branches are then grown as well as required floor area and enclosures creating clusters of spaces.

In parallel to the initial parameterization phases and generative procedures, optimization routines are integrated in the process in order to improve structural and environmental efficiency at micro level. This implies that in addition to environmental conditions internal geometrical constraints are embedded in the recursive systems. These internal conditions are defined based on spatial and programmatic requirements. Eventually, the cyclic nature of the designed computational flow allowed the team to explore and test the performances of alternative designs for different seasons. This resulted in the development of meaningful designer interventions into the optimization process.

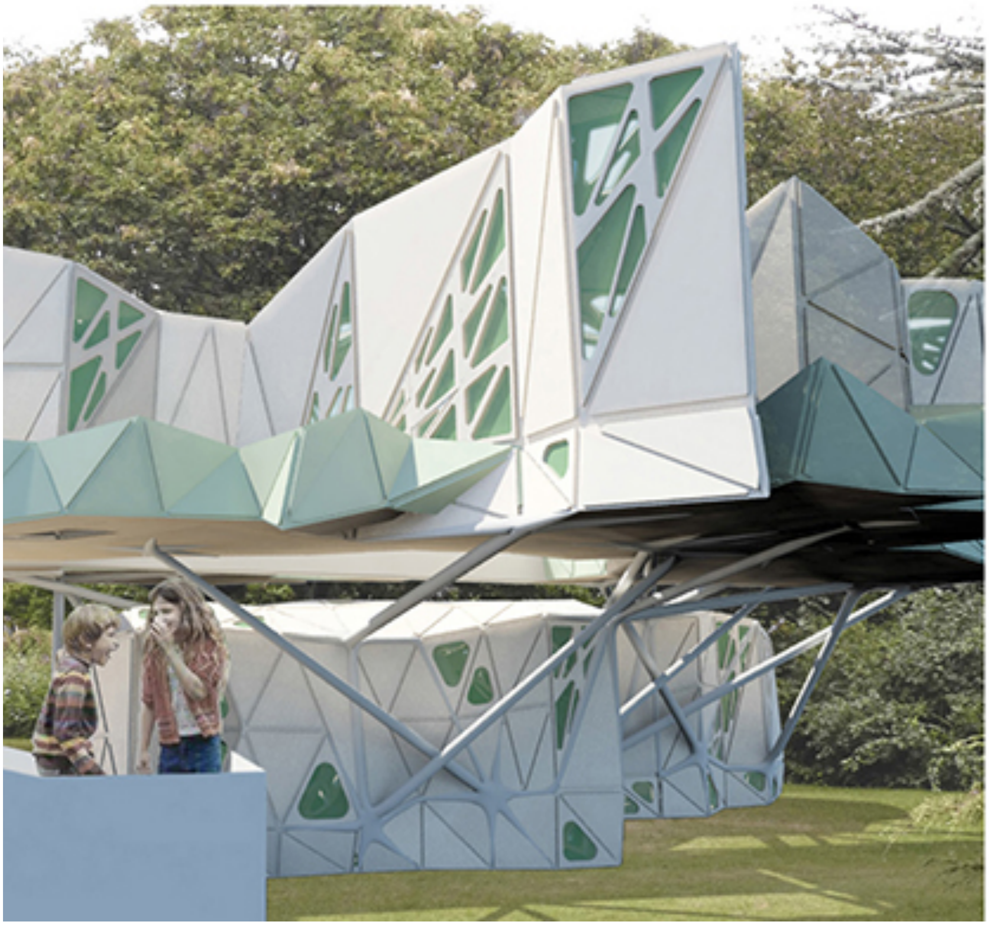

Figure 5: Renders illustrating spatial and morphological quality of the eco-locator project

This experimentation has proven that integrating complex generative system within a holistic design information model for data exchange between different stages of computational design processes, not only makes the complex systems more applicable and informed, but also establishes a balance between top-down decisions and bottom-up emergence processes.

3. Conclusion

In generative design processes natural and artificial agents operate as actors involved in creating meaning at both material and semiotic level and humans represent only one of many possible agential embodiments. This understanding relies on De Landa's neo-materialist cultural theory that rejects the dualism between nature and culture, matter and mind, natural and artificial, wherein reality is revealed in material, self-organized processes. In this context and in opposition to Alberti's (1452) formalization of (notational and authorial) architectural representation[17] consisting of plans, elevations and sections from which materialization is implemented, multiple and various architectural materializations emerge today from interactions between (natural and artificial) agents while authorship becomes hybrid, collective, and diffuse.

Thus notions such as original, copy, production and reproduction are subject of redefinition: If the apparatus used to create (pen) was in the age of mechanical reproduction different from the apparatus used to make copies (printing machine), today, these apparatuses conflate (into one computer-numerically controlled system) blurring not only the distinction between original and reproduction but also between representation and generation[18] due to the processes through which physically built space is produced and utilized. Multiplicity and variation imply, therefore, not only that design emerge from local interactions between non-human and human agents but also physically built space incorporating computer-numerically controlled (non-human) agents adapts and reconfigures in response to human needs.

While architecture are increasingly incorporating aspects of non-human agency employing information and knowledge contained within the (worldwide) network connecting electronic devices, the relevant question is not whether interactive, reconfigurable environments may be built, but how (artificial) intelligence may be embedded into environments in order to serve everyday life. In this context, data-driven architecture are not only produced (created or designed and fabricated) by digital means but are, actually, incorporating digital, sensing-actuating mechanisms[19] that enable them real-time operation and interaction with environments and users.

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[17] M. Carpo, ibid.

[18] W. J. T. Mitchell, Picture Theory - Essays on Verbal and Visual Representation, University of Chicago Press.

[19] H. Bier and T. Knight, ibid.

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Self regulation as a tool for the management of the complexity in architecture

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Abstract: This work is intended to rise topics of discussion, based of the idea that the uncontrolled urbanization that some of the cities of the Eastern Bloc, faced after the fall of the communist system acted following inner rules that emerge from the interaction of uncontrolled agents in the territory. The emergent set of rules can be reused in creating design tools, useful for the architect acting in environments in contiguous and unpredictable contexts.

Keywords: Self-regulation, emergence, uncontrolled urbanization

1 From control to spontaneity

The failure of the communist system and the subsequent cure of the shock created, at the beginning of the nineties, the necessary conditions for a radical change of the entire social and cultural context in the countries of the Eastern Bloc. The major cities, created or developed reflecting a social structure, based on equality and therefore tending to the standardization of needs and activities, had to readjust to the new paradigm of the free market and competition. The physical inability and unwillingness of the authorities to act as a regulator of the system created an additional ingredient for the emergence and development of economic and building informality.

The research hypothesis is structured on the assumption that the conversion to free market rules of the ex-socialist cities and their subsequent densification, which occurred after the nineties, without any control by the authorities, acted according to internal rules, which spontaneously emerged from the interaction, the conflict and the collaboration of individuals and other agents in the territory.

Self-regulation is considered be able to create urbanity because, through continuous change and adaptation, it is able to give life to articulated behaviors, producing complex spatiality, characteristics it shares with the contemporary city. Self-regulation acts according to internal "rules", which among other things, are similar to the "rules" that determine the behavior of many natural processes and that, if understood, can become instruments, not only for the management of complex processes but also for architectural design.
The objective of the present work that arises, is to understand, re-adjust and re-use some of the features demonstrated in self-regulated behaviors, as a means of intervention and design within contemporary complex contexts.

The methodology of investigation of the problem of self-regulation and its possible spatial variations is based on the concept of "Theory and Science of Systems" , introduced by Ludwig Von Bertalanffy. The systems theory proves appropriate for reading and the interpretation the mechanisms that govern the self-regulating settlement systems because it proposes to start from the definition of "system" as a set of interacting components to derive concepts and characteristics of organized sets as the interaction, the centralization, the competition and aims to apply them to concrete phenomena. A systemic approach to the complexity would allow to interact with the entities within the system, through an "economical" use of information, creating spatial simulations where the compromise, the conflict and the collaboration would ensure the flexibility and responsiveness of a unstable equilibrium, characteristic of urban realities in the process of rapid change.

The most appropriate simulations to this research are based on "The Game of Life", a cellular automata algorithm, where a group of cells, following a limited number of rules, is able to create a complexity of spatial configurations and behaviors without being controlled by any external or superior entities. This non-deterministic algorithm, will form the basis of design tools that will be developed in the course of this work.

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Evolutionary computation of architectural objects

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Abstract: Recent developments in mathematical biology have allowed for a systematic approach towards understanding nature's complex process of evolution and development. In addition, rapid developments of computational tools have allowed the simulation of biological processes in design fields such as architecture. The proposed research explores a subset of concepts and techniques from mathematical biology for their potential incorporation into the design process. The research will extract mathematical logics from evolutionary biological processes and apply those mathematical concepts in digital design to establish a systematic approach towards the generation of architectural objects.

Keywords: Computational morphogenesis; dynamic models; evolutionary algorithms; emergence; architectural objects

1 Evolutionary Computation in Design

1.1 Mathematical Models

Recent developments in mathematical biology have allowed us to understand and abstract complex biological processes using mathematical models. Mathematical models are scientific models that describe a systematic process using mathematical equations. Such models are advantageous in describing complex organisational principles and behaviours similar to those found in biology, by abstracting simple rule-sets from which higher order complexity and organization emerge. Biological models are embedded with dynamic qualities of complex, non-linear processes that take place over time through feedback of the system's members. As complex as they are, mathematics allows us to understand and explain the rationale embedded in the development and reproduction of biological forms (Ball, 1999).

Computational techniques such as evolutionary computation take advantage of mathematical logics of evolution and biological development, to achieve design variations in the morphology of architectural objects and their organisation as populations. Within evolutionary computation, variations are random modifications or changes that occur in the system during each iteration. Iterations allow us to simulate systematic change over time in various conducts such as system development, patterns of movement (i.e. agent behaviours), equilibrium and relational models (i.e. reaction-diffusion).

1.2 Digital Genome

In biology, the instructions that are responsible for differentiated phenotypes are carried out by the genome. Genomic mutations drive phenotypic variations and the relation between genotype and phenotype are in no way linear. The phenotype is the result of interactions between the genome and the environment (Mayr, 2001). Darwin described the process of evolution as a gradual change that takes place over many generations; however mutations within the genome will change the morphology of an organism in a very short period of time (Gilbert, 2003). This is in large because the structure of the DNA is almost identical throughout different organisms; it is rather the sequencing of the genome that differentiates organisms through their phenotype. Thus, mutations within the sequencing of the genome will dramatically change the physical trait of the organism.

In evolutionary computation, algorithms can be said to be the genome of the object which carry out instructions, and the physical properties of the object (its geometry, materiality, organization and other attributes) represent its phenotype. Therefore, through algorithms we can simulate the evolution of progenies or descendants of objects by tracking and transferring digital genomes from previous ancestors. The instructions are copied (through crossbreeding sets of instructions between 2 ancestor objects; or duplication a set of instructions for 1 object and applying mutative strategies), giving rise to a new generation of objects. Similar to natural selection, an environment will select the fittest individuals and eliminate the 'unfit'.

2 Architectural Objects

2.1 Morphogenesis

Computational morphogenesis is a process by which digital objects come into existence and develop their form. This process is dependent on digital information that must be embedded into the digital model. This information is responsible for controlling all phenotype properties of the digital object(s), similar to how a genome in living systems is responsible for the phenotype properties of the organism. It includes but is not limited to, properties that define its physical proportions such as area, height and orientation, and as the object develops, these properties will get more and more complex by added features such as a body-plan which dissects the object(s) up into body parts to allow for further refinement of the object(s) as it develops.

This aspect of the research focuses on the morphogenesis of architectural objects through sequencing of the digital genome. It establishes a methodology in generating populations of objects that are each highly differentiated in terms of physical attributes. After each iteration, the population is analysed based on a fitness criteria [defined by the user and relevant to the design intent] to select the fittest individuals. These individuals are selected to further crossbreed them for the next generation of descends. This process sets up a systematic approach towards establishing an evolutionary process that allows the evolution of architectural objects.

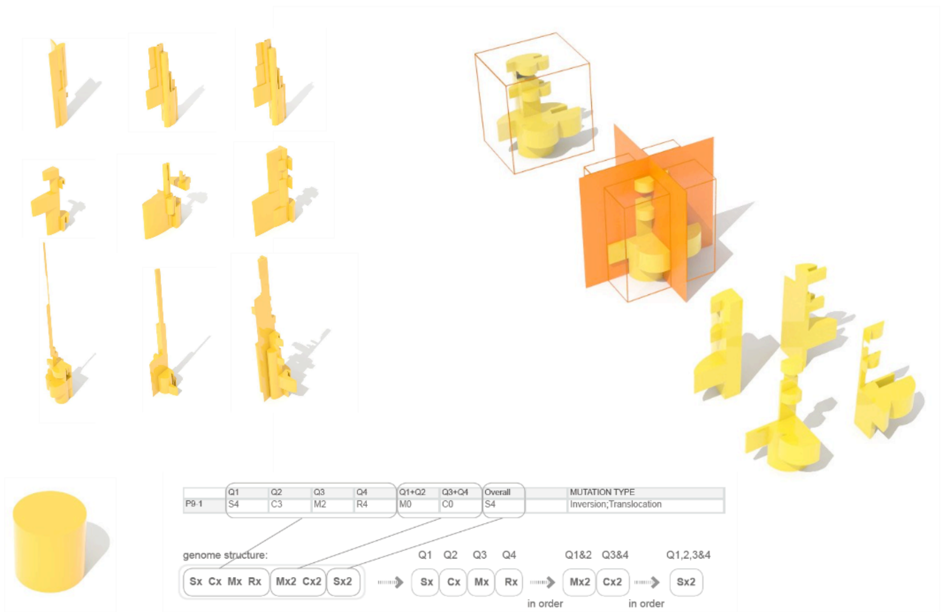

Figure 1: The evolution of digital objects through the sequencing of instructions [digital genome]. (Design experiment, 2010)

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Actuating (Auto)Poiesis

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Abstract: Creativity in the natural and human worlds is distinct. Designers have always looked to nature as a source of inspiration and in recent decades the computer has been used as a tool to engage with the self-organising and emergent properties of natural phenomena. Used to simulate the dynamic behavioural properties of natural systems the computer has been utilised as a means to open up a world of possibilities and to empower designers to create novel productions. However, whilst the computation is a powerful tool in design which has led to a paradigmatic shift in the sorts of artefacts designers create it has not as yet led to a paradigmatic shift in how we think about designing and creativity. This is because novelty is rarely intrinsic to and thus an outcome of the computational process architects and designers engage with in the simulations they use to explore and design. In this paper we consider the capacity to effect novelty in computational (architectural) design. We propose that whilst autopoiesis is an intriguing concept it does not offer a means to effect novelty, because the identity of an autopoietic system is integral to its constitution. Only by breaking a systems identity may we affect novelty when trying to create through self-organising and emergent processes.

Keywords: Autopoiesis; Novelty; Complex Adaptive systems; Computational Architectural Design; Spatial Relations.

If architecture is an art of making distinctions (Mitchell 1998) which an architect then materialises to form some building it is then a bilateral process of production: as it were a polycephalic condition in which two sides are part-and-parcel yet separate. The age-old adage that architecture is a discipline, which bridges the arts and the sciences. This distinction (between the organisational and materialisation of built form) is what separates the process of creation in the biological and human worlds. Biological phenomena are the product of processes in which organisation and materialisation are intrinsic. There is no distinction. They are conflated, such that they are ubiquitous throughout the process of production.

Whilst biology and the natural world has always been a source of inspiration for architects it has until recently been a matter of analogy (Steadman 2008). However, with the ability to simulate biological processes through the computer architects can now engage with the creative capacity of complex dynamic systems, and explore new methods of organisation and form generation, which reflects the ubiquity of nature. From this stance designing becomes a process of initiation; whereby a process of creation is enabled, dice are rolled and the designer becomes composer bending and leveraging the process towards some point. To design is redefined, on the basis that design is traditionally to configure and define something externally, whilst to create (biologically) is to embody a making process. Ones perspective is thereby transferred from being outside some composition of discrete elements to be assembled to generate a whole to being within a system and having the capacity to steer, nudge and cajole the constituents of that system. This suggests the individual engaged in this process is somehow affecting novelty in the system, such that the user has the capacity to bend and push the system into new domains and spheres of being. This however requires that novelty is introduced into the system; otherwise the system is merely altering its state in response to the perturbations being placed upon it. If novelty is not introduced the result of the process is no more than reconfiguration. We propose that configuration and recombination is the typical manner in which computation is utilised in architectural design, and that whilst this is a powerful use of computation (to engage with natural processes of making) it does not tap into the creative capacity of making in nature. At root, the manner in which computation is typical employed in (architectural) design is determined by the information fed into whatever process is simulated. If no novelty enters into the system then all that is gained is a recombination and/or reconfiguration of the information fed in at the beginning. Whilst this does open up a world of possibilities intrinsically the system does not offer anything new. In this paper we look at the capacity to engage with the creative processes of biological systems to stimulate novelty and argue that we need to get deeper under the hood to effect novelty.

Autopoiesis is an intriguing concept to look to and to embrace as a means to engage with biological creativity, because it demonstrates how a living system is created, and is self-generating (Maturana and Varela 1980). An autopoietic system has no other purpose than to persist, and if the dynamic circularity is interrupted then it disintegrates. Coupled to its environment an autopoietic system draws from and thus conveys to its environment, meaning the system has identity, because it is different from that which surrounds it – for it must different to exist. The boundary between system and environment is therefore pivotal. The boundary is a ‘component’ of the system which is distinguished through its ‘form’, which is determined by its structure and the difference between itself and the environment (Luhmann 2006). The boundary between the self and other is essential for the system to exist. “[The] point of departure for all systems-theoretical analysis must be ‘the difference between system and environment'. Systems are oriented by their environment … They constitute and maintain themselves by creating and maintaining a difference from their environment, and they use their boundaries to regulate this difference" (Luhmann 1995, p16-17).

The way in which systems are perceived through the concept of autopoiesis is spatial, in that the components of a system are a complex of interactions distinguished by their structure, which determines a closed unity. A boundary condition is thereby defined, through which the system is structurally coupled with, but has autonomy from, the environment. The system is intrinsically different and being distinguishable has identity. The concept may be seen to share similarities with the notion of buildings as systems of spatial relations, and one may at this point be drawn into thinking about social systems and architecture autopoietically (Luhmann 1986; Schumacher 2011). Autopoiesis is an intriguing concept because its central concern echoes what Henri Lefebvre argued about space; that it is something which is produced as well as productive (1995). Space is thus perceived as an active phenomenon which manifests itself and persists. From an ontological perspective of the generation of spatial organisation, autopoiesis is a way of conceiving the production of spatial formation, through modelling the self-organising autonomy of various constituents. It is this aspect, which offers architects a new conception of space and the capacity to generate spatial formations. Autopoietic organisation 'constitutes a closed domain of relations' that are 'specified only with respect to the autopoietic organization that these relations constitute'. The process defines "a space in which it can be realized as a concrete system, a space whose dimensions are the relations of production of the components that realize it" (Maturana and Varela 1980, p88).

Autopoiesis (Maturana and Varela 1980) and Varela's concept of autonomy in biological systems (1979) refer to the topological configuration of networks arising out of component interaction. They do not take into account the quality of spatial relations. "An autopoietic system is defined as a unity by and through its autopoietic organisation. This unity is, thus, a topological unity in the space in which the components have existence as entities that may interact and have relations" (Maturana and Varela 1980, p93-94). The premise is that some characteristics of space comply with those of a complex adaptive system which produces its own organisation, in response to differences in its environment. What this leads to is the intention to translate these differences (information) into 'object', but whilst topology is (perhaps the most typical) means to qualitatively think about space it only accounts for connection and wholes. Spatial relations are more varied than the typical topological focus allows for. We must move beyond topology to incorporate the mereological aspect of parthood relation (Varzi 1996). By allowing for parthood relations we enable variance into the system and thereby allow for differences to occur, on the basis that 'a difference is a difference that makes a difference'; which 'perceived over time' is what we call 'change' (Bateson 2000). Difference is required to alter or affect new states and create asymmetry in the system, and only through difference being either added to or evolving from within the system may novelty occur (Cariani 2008). We need to affect the system to effect change in the system, thereby allowing the system to construct new domains that put its identity into crisis and enables the actualisation of new potentials to emerge.

Approaching spatial formation in relation to a complex dynamical system, we perceive a system as "diverse and made up of multiple interdependent elements, that are often adaptive, in that they have the capacity to change and learn from events, and that can be understood as emerging from the interaction of autonomous agents" (Johnson in Alexiou et al 2010, p123). In this way the capacities of an element are not only structurally determined but are brought about through the interplay of a three-fold process; which includes the meaning of how one element relates to another, and the history and circumstances under which one element encounters another. The central premise of autopoiesis is that living systems replicate themselves, recreating their components (Maturana & Varela 1980). What is explained is persistence. Change is not an aspect of the system. Autopoiesis is an abstract concept to explain living systems in a manner that is transferable to explain persistence of a system. On the basis that to design is to construct (Glanville 2006) it is tempting to transfer the notion of autopoiesis to design but in so doing we only embrace regeneration and do not engage with novelty. Design is a social process and social systems have the capacity to change and renew. Renaissance is fundamental to the persistence of social systems. Designers need to engage at the level of components and interfere with the persistence of the system to enable novelty in the system and effect new identity(s).

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A UK registered architect, with several years experience working as a senior and project architect in small-scale private and large-scale international practices. Tim left commercial practice in 2008 to concentrate on his PhD. In 2011 he became a Senior Lecturer at the Leicester School of Architecture where he teaches design studio at undergraduate and post-graduate level. Awarded an EPSRC research grant in 2008 he completed his Ph.D. in Architecture and Computational Design at the Bartlett School of Graduate Studies, University College London. His research is a synthesis of algorithmic and biological design thinking applied to the conception of architectural space.

Concerned with the problem of space and the configuration of space in architecture, his research is a combination of (i) synthesising several different strands of theoretical work on conceptualising, representing and analysing space and spatiality, and (ii) developing computer codes that simulate bio-inspired spatial self-organisation. The purpose of these two endeavours is to (i) probe and improve the concept of space for architectural practice, and (ii) make a case for the use of such computational tools as creative stimuli for early-stage design processes; on the premise that space, being an underlying feature of natural systems and everyday life, is emergent. Understanding space to arise from the interplay of dynamic habitual agencies, he proposes architects may benefit from embracing a decentralised approach to configuration in order to mediate and articulate inhabitation.

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Emmanouil is a PhD Candidate at the University of East London, UK, where his research on artificial cognitive processes and artificial neural networks allows him to computationally and theoretically explore the possibility of a non-human non-neuronal cognitive process. The purpose of his research is to link the learning capacities of an algorithm with the ontogenesis of architectural form. Emmanouil is a registered architect in Greece holding a diploma in Architecture from the School of Architecture, Aristotle University of Thessaloniki, and a postgraduate degree in Digital Architecture Production from the Institute of Advanced Architecture of Catalonia, Spain. He was co-teaching the MSc Architecture: Computing and Design with Paul S. Coates in School of Architecture, Computing and Engineering, University of East London since 2011. From 2011 to 2013 he was the acting programme leader of the Course. Currently Emmanouil is a visiting lecturer at the MArch Urban Design, Bartlett School of Architecture, University College London where he teaches theories related to morphogenetic processes of urban realm.

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Neuronal ecosystems, towards an ecology of aesthetics

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Abstract: The object of this paper is to explore ecology as a complex field of architectural system-based design, and more specifically, as a field worthy of aesthetic consideration. In the post-digital age, the modern field of progress is hampered by various ideological stakes relating to the environmental and ecological awareness of place. These preclude the consideration of both the eco-systemic environmental approach, and the potential for cultural and technological evolution that is independent of new material conditions and new design tools that may be perceived as new forms of perception that also give meaning to place. The purpose of this paper is to connect ecology and aesthetics with neurology as an intermediary. The physical movement of an individual in space is the factor that defines changeable spatial fields. These are articulated in the intermediate space in which both the ecological approach and the aesthetic consideration emerge, simultaneously rendering “neurons” as the administrator of the aforementioned relationships. Thus an ecological approach to aesthetics carries new methods of contemplating the city as recursively structured, autopoietic, living matter. The city is perceived as a neuronal ecosystem which may develop similar patterns to the human nervous system. To this end, comprehension of the urban structure as a neuronal ecosystem refers to the potential positive effect of applications based on systemic concepts with the purpose of improving living conditions in densely populated urban centres.

Keywords: ecology, aesthetics, neuron, ecosystem, urbanity.

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This extended abstract is available from http://emcsr.net/book-of-abstracts/

1 Reinterpreting “ecosophy” through aesthetics

In order to clarify the correlation between the ecosystemic approach and the aesthetic approach, it is particularly necessary to reinterpret the three ecological scales via the notion of “ecosophy” as described by the French philosopher Felix Guattari. “Ecosophy” comprises the intersection of the three varieties of ecology, which are on the one hand distinct categories due to the different practices they follow and the different scale of relationships to which they refer. Despite this they appear to emanate together in a constant process that enhances subjectivity (Guattari, 2000). According to Felix Guattari, subjectivity is produced at the point of intersection of the three spectra of “ecosophy”, composing a broader network of subjective, collective, and environmental references.

More specifically, “mental ecology” refers to the composition of the human subject, “social ecology” shifts towards the relationship of an individual to the rest of the social group, while “environmental ecology” comprises a process of constant negotiation determined by the relationship of the individual to the totality of ecosystems.

- Mental ecology and the human mind
- Social ecology and the growth of relations
- Environmental ecology and the development of ecosystems

Within this line of thought, the introduction of a fourth ecological scale is attempted. This seems to have influenced Felix Guattari’s work, and is also likely to comprise the most significant interconnection between the ecological eco-systemic approach and the aesthetic perspective during the 20th century. In other words, it is a perspective comprising a highly significant field of interconnection between the human experience and the meaning of place with its social and environmental references, as developed through the notion of “aesthetics” by 20th century British anthropologist, biologist and cyberneticist Gregory Bateson.

1.1 The ecological extension of mind

According to Bateson’s basic theoretical schema, human consciousness is described as a mental process that extends beyond the bounds of each individual mind, since it is connected to a wider network of ecological correlations. As he notes, the ecological principle penetrating the totality of living organisms is comprised of relationship networks that interconnect the various activities developed by organisms through their internal nature, as they receive data from the external environment with which they come into contact.[1] In this case the eco-systemic perspective relates to the “ecology of mind”, as a semiotic system of communicative correlations is composed and develops between the organism and the environment. The “ecology of mind” thus synchronizes the totality of subsystems in an integral, common system connected with a framework on a global scale.

> *'The individual mind is immanent but not only in the body. It is immanent also in the pathways and messages outside of the body; and there is a larger Mind of which the individual mind is only a subsystem [...] immanent in the total interconnected social system and planetary ecology.'* (Bateson, 1972, p. 468).

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1 In this way the eco-systemic understanding of perception is more directly connected with the theoretical work of the Esthonian biologist, Jakob von Uexkull as a general field where spatial conditions are recorded, which refer to processes of linguistic and symbolic coordinates as dominant fields of development of social perception, via “communicative circles” that simultaneously introduce the notion of `Umwelt'. (Kull K., 2001, p.7).

Finally this intent is related to the ability of organisms to develop relations both with each other, as well as with the external environment through ecological patterns that are primarily associated with the Mind. (Bateson, 1979) Bateson's aesthetic perspective thus refers to the ability of patterns to respond to the environment by composing a wider matrix of ecosystemic references.

1.2 The ecology of aesthetics

The ecological extension of Mind appears to be connected with the notion of "aesthetics" as developed by Bergson, on a second level; as a formative premise that refers to the responsiveness to the pattern which connects.[2] Therefore, his use of the term "aesthetics" comprises a conceptual challenge that perceives human existence as an expanded ecosystem, both embedded in the environment and extended beyond it.

Bateson's most significant contribution to systems theory in the post-digital period appears to be the attempt at developing applications based on systemic concepts through the interconnection of multiple scientific domains for the resolution of global problems which acquire a greater intensity and scope for investigation in Metropolitan centres.

2 Neuronal ecosystems

According to this line of inquiry, cities can be regarded as complex neuronal ecosystems that manage patterns of information. Through feedback they transform the existing structures by drawing upon neurological references and the sensory-kinetic mechanisms of the human action-reaction system.

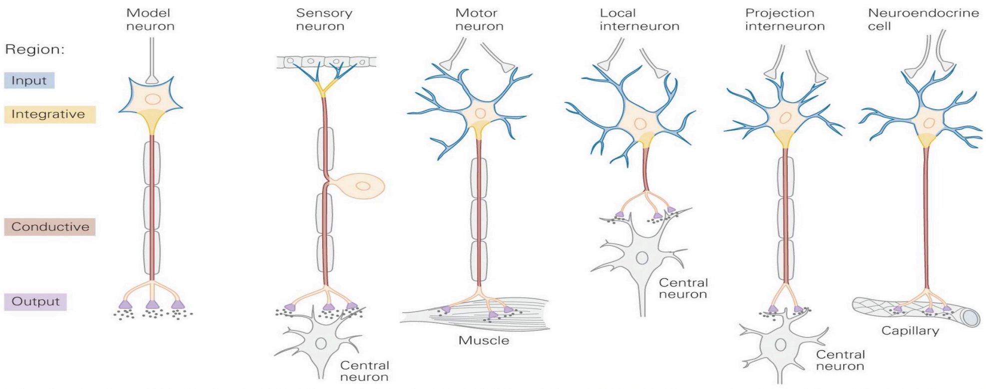

Figure 1: Most neurons, regardless of type, have four functional regions in which different types of signals are generated (Principles of Neural Science, 2013).

2.1 Perception as an extension of the human mind.

Human perception has become extended beyond the immediate field of physical influence which has become entirely technological since the individual is constantly interconnected with a unified information network. The Mind has become extended to such a degree that its dimensions extend into infinity. Nevertheless, the new perceptual reality cannot remain independent, both due to the direct contact that develops between minds, and the potential contact shared by the interconnected bodies. Thus, the body becomes a network, and the network becomes a sentient body. (McLuhan, 1962).

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2 *"So by 'aesthetics' I mean responsiveness to the pattern which connects. The pattern which connects is a meta-pattern. It is a pattern of patterns. It is that meta-pattern which defines the vast generalisation that indeed it is patterns which connect".* (Harries-Jones P., 2008).

The incoming sensory information received by the human body during its contact with the external environment activates combinations of neuronal firing in the brain, resulting in a wholly interactive environment which transforms the incoming sensory data into outgoing potential actions of the human mind. (Coward, 1990). Hence the key elements in the human brain are the feedback loops which connect the outgoing information with primary neurons, reinstating the constant flow of emergence of new actions. (Spitzer, 1999).

2.2 The city as a neuronal ecosystem

Therefore, an attempt is made to connect neurology with architectural ecology with the purpose of developing an eco-ontological approach according to which aesthetic patterns can activate different sensory-kinetic functions of the central nervous system within the urban structure. Thus turning it into recursively structured autopoietic living matter (Schumacher, 2012).

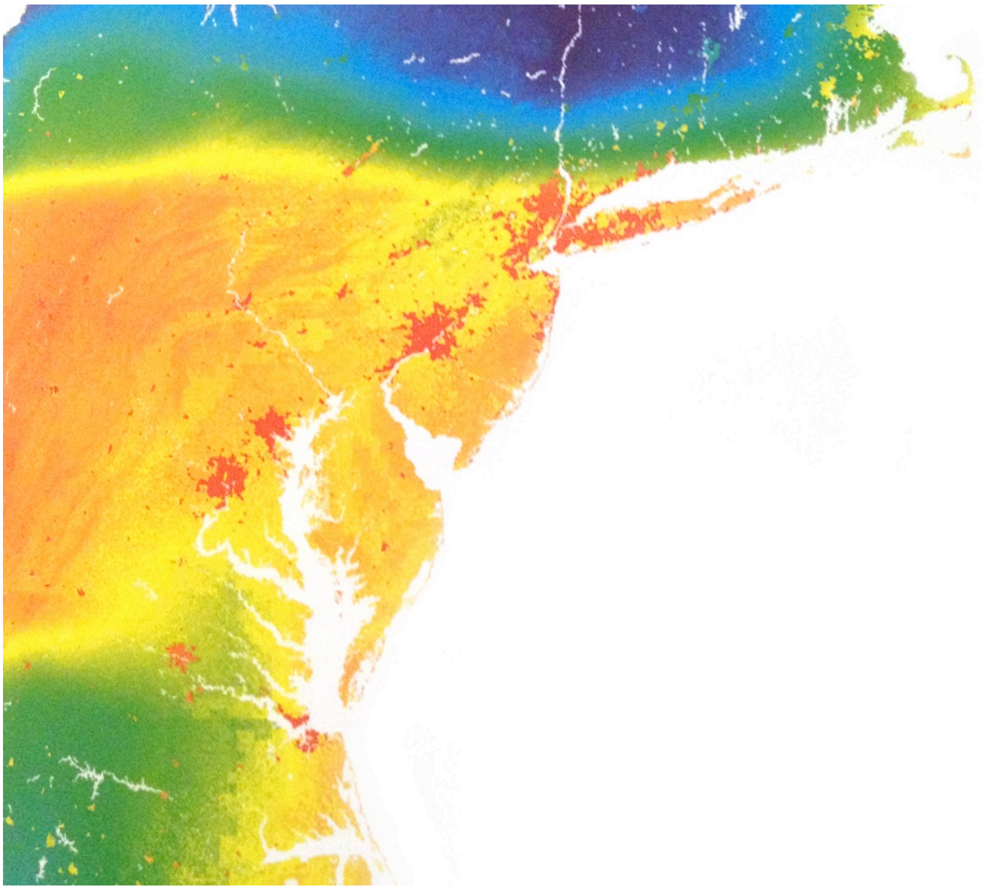

Figure 2: Average outgoing thermal radiation along the eastern seaboard of the United States as predicted by NASA's Land Information System for June 11, 2001 (Addington M., 2010/2011).

The transportation, water, energy, communication, waste collection and disposal systems are basic infrastructures of a city that must be dealt with. In addition, matters such as thermal radiation, wind flow, reflection, heat transfer, connectivity, sky view factor, open space, privacy, density, porosity, contiguity, opacity and noise pollution are only a few pieces of information that can be input as data for processing all aspects of management of an urban network. By approaching the city as a neuronal ecosystem, which is to say, as a living organism, living conditions within the urban structure are improved, offering the individual multiple ways to inhabit the space, simultaneously activating the daily experience and meaning of densely populated urban centres.

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Alexandros was born in Athens, Greece in 1986. He graduated from the School of Architecture at the National Technical University of Athens (Diploma grade: 9,54/10,00 - 2011), and continued with postgraduate studies at the NTUA postgraduate program specializing in "Design-Space-Culture" (Diploma grade: 9,94/10,00 - 2013). During the course of his studies he has received a number of Scholarships and Awards (Lyssandros Kaftantzoglou Award - 1st Prize, Kalliopi Venizelou Sfaellou Award - 1st Prize, I.K.Y (State Scholarships Foundation) Award and Honorary Scholarship, Onassis Foundation Honorary Scholarship, Propontis Foundation Honorary Scholarship, I.K.Y (State Scholarships Foundation) Honorary Scholarship). He is a PhD candidate and Teaching Assistant at the NTUA school of Architecture. He has participated in research projects and has received awards in Greek and international architectural competitions. His work has been acclaimed by the Technical Chamber of Greece and has been exhibited at the 1st Architecture Biennale of Thessaloniki and the 7th Architecture Biennale for Young Architects in Athens. He is currently collaborating with architectural companies and is founder of the ALEXANDROS KITRINIARIS I architecture.

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City retrofitting through cultivable envelopes

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Abstract: Today's humanity, a blind ascetic walking on a ramshackle cliff path, is scrupulously seeking the way named 'sustainability' to survive and striving to see the 'sunrise of tomorrow'. Neither staying nor impertinency means death. Indeed, humanity has undergone an extremely rapid development since we predominated. The extraordinary intelligence has been constantly transforming the world to our expectation which contains advanced technology, high level of civilization, and also potential risks. However, as the exposure of the potential risks comes, it is time to pay back! Hence, people are exploring almost all the possibility to live sustainably in order to prevent from the deterioration of the current population increasing, food shortage, environmental pollution, climate change, sea-level rise, catastrophes and social chaos, before everything spirals out of control.

This study will explore how the problem of reducing emissions of greenhouse gases and the growth of the urban population can become an opportunity to increase the food production through the use of cultivable envelopes.

Keywords: city; retrofitting; envelope; sustainability; hydromembrane; cultivation; design; hydroponics; aeroponics; seismic; retrofitting; comfort; CO_2; Auckland;

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1 Cultivable envelopes as a solution for the global food shortage

There are approximately one million people suffering from chronically malnourished, despite the fact that the largest land use of the earth's surface is occupied by agriculture[1]. The global food production and food supply have to rise to the challenge of continuous increasing population and arable land loss. The climbing world's population increases the burden of food supply which has already stepped in awkward situation. The eager for food drives people to unreasonably use or even abuse their farmland, and subsequently, some of these land resources lose the ability of recovery and turn to infertile, some others irreversibly become desert. As a result, the problem of food shortage is upgraded.

The overlook of the environment during economic development brought about the resulting predicaments: greenhouse gases emissions from industrial production and other aspects of people's life catalyse the process of global warming. Sea-level rises with the melt of glacier caused by the warmed temperature. This not only increases the risk of flood in coastal areas where economic advanced cities often locate, but also threatens the existence of some low-laying countries. Also, the cities' capacity of resisting earthquake will be reduced by the influences of sea-level rise. The world will be lost in a sense of chaos. The instinct of people forces themselves to spare no effort to survive. To make a choice between 'Death' and 'Chaos' to face hunger and disasters, probably people prefer to live with social chaos, loss of ethic and even worse rather than death. The horror and tragedy of 'Real-life Hannibal' may take place surround us. The chaos is going to stifle sustainability and the destination of humanity in the cradle.

1.1 Cultivable envelopes through the use of Hydromembrane[2]

The literature on Retrofitting reminds us that the study of the envelope performance is one of the most effective strategies for the reduction of greenhouse gases and the comfort increase. This study is an exploration which attempts to resolve the contemporary issues by practising a new system constituted by hydromembrane and seismic retrofitting structure creates more possibilities to offset the advantages of green roof and green facade techniques which are efficiently able to reduce CO_2 emissions and the influence from Heat Island Effect in urban cities. In this system, the greenery improves urban environment and ecosystem, promotes the level of comfort and solves the problem of food shortage and resulting social chaos. On the other hand, the seismic retrofitting structure gives humanity the dependence and confidence to overcome disasters. The present study considers the hypothesis of using the aforesaid envelopes for the production of food, as well and its positive/ negative impact with respect to the mentioned conditions of retrofitting.

1.1.1 Application and Advantages of the use of hydromembrane in the cultivable envelopes

Food production is an extensive field of research which is not part of this study. Therefore, the most representative, conventional and hydroponic typologies have been taken into

1 Gore, A. (2013). *The Future*. UK: Clays Ltd.
2 The cultivation system through Hydrogel membrane has been patented by Mebiol Inc. (2014). See http://www.mebiol.co.jp/

account to select what could fit better with the retrofitting intentions through the use of building envelopes:

- Soil Cultivation
- NTF System
- Inorganic Rooting Medium
- Aeroponics
- Cultivantion on Hydromembrane (IMEC)[3]
-

Table 1: Features of tomato cultivation in different systems ***(Data provided by Mebiol[4], Hydroponic Guideline 2013[5])***

Types	Area	Fertiliser (Nitrogen, Phosphorus,Potossium)	Sugar (mg/100g)	Gltamic Acid (mg/100g)	GABA (mg/100g)	Lycopene (mg/100g)	System Cost & Running cost	Feasibility
Soil-based	1000㎡	28kg, 20kg, 26kg	4	172	28	4.3	-	Suitable Top Soil
Hydroponics	1000㎡	＞3.6kg, ＞1.4kg, ＞7.6kg	4	157	28	3	US$100000-200000	Anywhere
IMEC	1000㎡	3.6kg, 1.4kg, 7.6kg	7.6-12	408-478	124-157	10.8-13	US$45000	Anywhere

Hydroponics is fortunately capable of providing more food production in both high quantity and quality to diminish and even dispel the harassment of food shortage because it requires no soil throughout the procedure of food cultivation[6]. The flexibility of hydroponics helps people to breakdown the limitation and dependence of agriculture to fertile soil and meanwhile, extends range of food source. In turn, hydroponic systems are scientifically controlled and only deliver necessary water and nutrients to growing plants; as a consequence, the input of water and fertilisers that supports plants' growing is sharply minimised[7]. This not only creates more accesses of food production against to the prevalent hunger, but also avoids soil resources from degradation and loss. 'Hydomembrane' as an upgraded hydroponics not only inherited and enlarged the advantages of hydroponics, but also improve the quality and nutrient content of food production. Being the hydromembrane the only difference between a hydromembrane system[8], and a normal house soil culture system, the cost of the hydromembrane system could be higher than the traditional soil-based cultivation but cheaper if compared to hydroponics. If we consider the richness of nutrients and lower costs, compared to traditional domestic cultivation, for the use of water, fertilizers, hydromembrane systems are particularly suitable for building envelopes in terms of limited space and monitoring.

1.2 Advantages of the cultivable envelopes in retrofitting

This part of the study will analyze the positive impact of the cultivable envelopes with respect to the following aspects:

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3 Mebiol Inc. See http://www.mebiol.co.jp/
4 Ibid.
5 EnzaZadenBeheer. (2013). Enkhuizen. *Hydroponic Guideline*, The Netherlands.
6 Jones, J.(2005). *Hydroponics: A Practical Guide for the Soilless Grower.* Boca Raton, London, New York, Washington, D.C.: CRC.
7 Ibid
8 Mebiol Inc. See http://www.mebiol.co.jp/

- Seismic retrofitting
- Comfort increase
- CO2 emissions reduction

Several recent studies emphasize the importance of the green facades and green roofs to mitigate the heat island effect, with consequent reduction of CO2 emissions and benefits for the thermal comfort and the solar shading.

The present study, however, focuses on the potential of the combined use of vertical farming and green envelopes for the city retrofitting and on the further enhancement by an eco-structure adapted to the consolidation of the existing buildings in the seismic areas. In fact, to build resilient cities[9] to response the unpredictable disasters and to resolve the problems of increasing population and food shortage become the most crucial missions to complete.

The sporadic earthquake has threatened unprepared cities and overwhelmed citizens in different places. In some cases, thousands of people and million dollars of estate were taken by earthquake in a blink. Nevertheless, the immature technology in forecast of earthquake could not save all the victims by providing effective warning in time. Hence, to make preparations to respond the potential crisis will be the most feasible method to save people's lives. Without any reliable earthquake prevention, buildings transform from shelters to killers during earthquake event. As collapsed buildings falling apart, people's chances of survival are deprived. It is notable that seismic retrofitting structure gives the existing buildings longer lifespan, and whilst endows modern cities ability to resist earthquake and other disasters. Compared to destruction and rebuilding, seismic retrofitting achieves excellent outcomes with low investment, which is economic and sustainable[10.] The modern cities' requirement of sustainable development calls retrofitting to improve the current situation of architecture and urban planning, to increase the ability against disasters and to offset urban comfort. From another perspective, the demand of retrofitting is creating an opportunity to cities to make decisions of producing their food with new strategies.

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9 Lombardi, R., Leach, M., Rogers, F., & the Urban Futures Team. (2012). *Designing Resilient Cities: A guide to good practice.* Bracknell: bre.
10 Birkeland, J. (2008). *Positive Development: from Vicious Circles to Virtuous Cycles. London:* Earthscan.

2 Strategy application: the study case of Auckland City Central

The climatic conditions, the seismicity and the urban fabric make Auckland an interesting case study for our research.

A city centre block has been selected and its survey has been used to verify the available surfaces for food production and to determine their orientation with respect to the solar path and prevailing winds.

The data have been used, then, to formulate a hypothesis of productivity and cost of the intervention to assess the feasibility of the process in the medium and long term.

Figure 1: Downtown, Auckland City Central (Photo by Pengfei Li, 2014)

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Urban ontological systems

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Abstract: This paper and research work investigates alternative solutions to the conventional and widely accepted standards of urban planning models. In particular, the work describes a series of urban organizational components based upon *intensive differentiations*, as an ontological system. This methodology provides an opportunity to uniquely identify new systems of urban organizations determined by communities of interacting urban-agents.

Keywords: topological thinking, ecology, urbanism, urban metabolism, self-organization, morphology, intensive differentiations, cellular networks and mobility, landscape urbanism

This urban research attempts to employ systematic methods instead of the classical and geometrical regulation as an approach for analyzing our complex city organizations. These systems and the study of detailed relationships between the realities of material constituents, ontology, allow for a fundamental shift in urban design philosophy; *process* over *structure*. More similar to philosophy taken from the 1960's of Gilles Deleuze and Ludwig von Bertalanffy's general systems theory, flexible systems provide zones of intelligent parameters to populate, extend, and ultimately distribute as critical negotiations back into the city. Strategically the work here borrows clues from natural environments by identifying their conditional relationships in systems such as cellular mobility, scale-free networks, and biological behaviors. As hyper-model generations and adaptable arrangements are evaluated and re-modeled against analyses of existing site conditions, workable feedback loops and tendencies create a series of interconnected possibilities. These heightened systemic interconnections are precisely the manifestation technique implemented as an operable, large-scale urban morphology.

1 Not-to-Scale Modeling

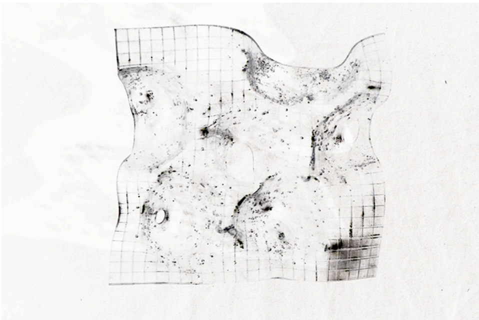
To initiate a systemic urban design strategy based on ontology, a meticulous process of relationships intelligently defines operable scale-free procedures. Three principles of organizational tools *logics*, *methods*, and *components* establish the explorations firstly through analog structures. For our intentions here, *logics* are defined as the assigned relationship rules between part-to-part in the development of internal interactions; *methods* describe and define the ways in which the simulations, or arrangement, are constructed; and *components* are the parts making up the assembly.

> *"The size of space is given by the number of possible rules. It can be calculated from the number of combinations of two variables: the number of states in which a cell can be and the number of neighbors with which it interacts. The number of states raised to the number of neighbors yields the combination of possible states in which each neighborhood can be." (DeLanda, 2011, pg. 28)*

Investigative relationships and logics between components are an attempt to create methods of organizational communities as DeLanda explains. Consequentially, this process is not a formal exercise of control. Rather, the process naturally emerges into results dictated only by the principle derivatives and logic sets of neighboring combinations. During this phase of the work, many quick sketch scenarios are produced. Then as the information between *components* to adjacent *component* is strengthened, the internal logics reveal a new repetition of difference as notably stated by Gilles Deleuze.

> *"The first repetition is repetition of the Same, explained by the identity of the concept of representation; the second includes difference, and includes itself in the alterity of the Idea, in the heterogeneity of an 'a-presentation'. One is negative, occurring by default in the concept; the other affirmative, occurring by excess in the Idea. One is conjectural, the other categorical. One is static, the other dynamic. One is repetition in the effect, the other in the cause." (Deleuze, 1994, p. 24)*

The system by virtue operates through a series of subtle differential relationships and defines a field of nondeterministic and intimately exchanged outputs. Initially, it might seem appropriate to stage complexity logics between components. Though only after a few iterations, it is clear that the simplification of rules and logics will form an evolution of internal complexity. Thus, the investigation uncovers that controlling the clarity of ‘local’, part-to-part interactions, will generate a more intensive and flexible result (Allen, 1999). Therefore, as the process of the study shifts into hyper-models and larger tools of urban implementation, variable configurations and adaptable simulations transpire into more effective morphological systems. The outcome is greater than the sum of its parts[1].



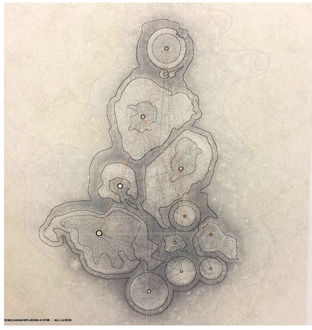


Figure 1 & 2: Analog – Economics Data and Cellular Mobility Study (M. Blake & C. Hammers, 2014)

2 Hyper-Populations + Evolutionary Behaviors

Developments of component relationships increase in sophistication as analog-models are transformed into a digital environment. The translation into ‘hyper-model’ simulations increases outputs of possible topological behaviors. Developed systematic topography is left to ‘self-generate’ rather than forcing an external, top-down process. Here, it is critical to increase the number of component populations in order to explore an optimum range of possible scenarios within the systems logic. Manuel DeLanda describes this ‘space of possibilities’ as a collection of behaviors that reach an intensive differentiation that sets limitations of a material state.

> *“…in the space of possibilities for the molecular population there exists a special point, the point of maximum disorder, and that the population is attracted to that state because it is much more probable than the others… The stability of emergent properties is explained by the structure of a possibility space and the fact that this stability can be displayed by entirely different mechanisms is explained by the fact that their possibility spaces share the same structure.” (DeLanda, 2011, p. 17-18)*

Influenced from this ‘possibility space’ philosophy, the hyper-models can be described as operational fields through activations of agent-like components that affect internal sequencing. The operational field studies consider four informative criteria: (1) creation of territories and variable differences to identify maximize potentiality in an operational feedback loop; (2) determine levels of sensitivity; (3) trace logics of informational exchanges; (4) identify moments of failures indicated by the extremities of intensive differentiations. As Ludwig von Bertalanffy initiated in the *general systems theory* from the 60’s, the feedback and communications derived from the simulations of systematic populations generate outcomes that transform evidence of internal structures back out to itself (Bertalanffy, c1968). Therefore, the conditional properties placed upon the sequential evolutions, critically formulate the characterization as a series of on-going didactic loops.

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1 Reiser, Jesse. Atlas of Novel Tectonics. “This methodology, in contrast to the reductive models of modernism, enables the emergence of new organizations and new architectural effects out of wholes that are not reducible to their parts.” pg. 50-51.

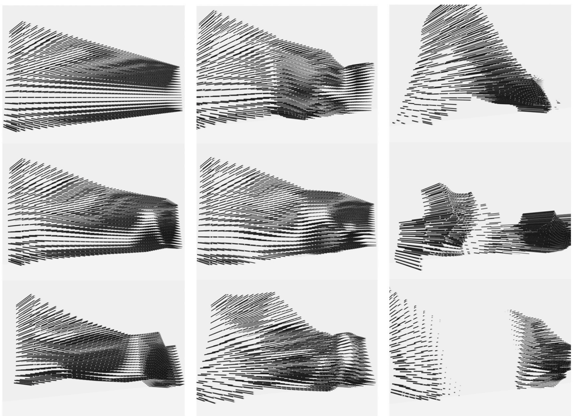

Figure 3: Hyper-Model (J. Nesbit, 2009)

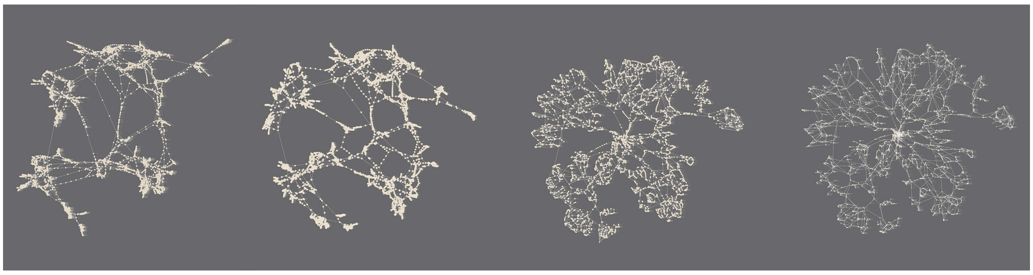

Figure 4: Digital Interface – Fragmented Networks (C. Hammers, 2014)

3 Urban Implementation and Negotiation

It is no surprise that the writings of Charles Waldheim and James Corner in the last decade suggest that the discipline of urban design and landscape are becoming more fully inter-connected. Although landscape and urbanism have been increasing in collaboration and is certainly not a new phenomenon, biological systems are clearly making their way into the formal thinking of the 'city as organism'. Stimulating strategies of landscape urbanism and utilizing current themes of self-generative adaptations, more directly charges the new progress and focuses on evaluating where, and how, the opportunities for horizontal extensiveness can be applied[2]. Formerly, infrastructures such as wetlands, sewage systems, transportation highways, and civic utilities have been regarded as tertiary, service space. These ontological systems modeling may seem a new trend in urban philosophy. Clearly this is not the case as we can trace influences back to the 1960's. As presented in his design manifesto on "*Investigation in Collective Form"*, Fumihiko Maki prescribes generative tools of urban transformation by way of infrastructural obligations and early large-scale systematic thinking[3]. Evidence of contemporary methods of re-thinking the usefulness of the public realm on, in, below, or between hard edges of large-scale urban infrastructure is vital for the continual growth of mega-populations. The process of activating this residual space by transforming it into habitable, public space provides heightened operable use of the available land and advances opportunities of creating a more

2 Shane, David Grahame. Urban Design Since 1945. "This shift towards city territory as space between fragments containing flows of energy and information between urban actors in a mixed ecology of uses." pg. 256.

3 Maki, Fumihiko. Investigations in Collective Form. Here Maki describes systems as a large-scale mega structural condition which smaller components may plug in or out of to create optimum temporal states. pg. 11-12.

sustainable environment. Shifting our ideas of horizontal landscapes can translate into urban interfaces of data and information. The expression of natural conditions in relationship with city infrastructures both define scenarios of urban patterns and negotiate layered informational histories and cultures. This systematic negotiation demonstrates a layer of extended, transformable tissues oscillating conditions of time, economics, politics, and social agencies. This is precisely why the work critical negotiates between morphogenetic zones of intermediary dimension and manipulates the horizontal, urban plane as a process rather than structure.

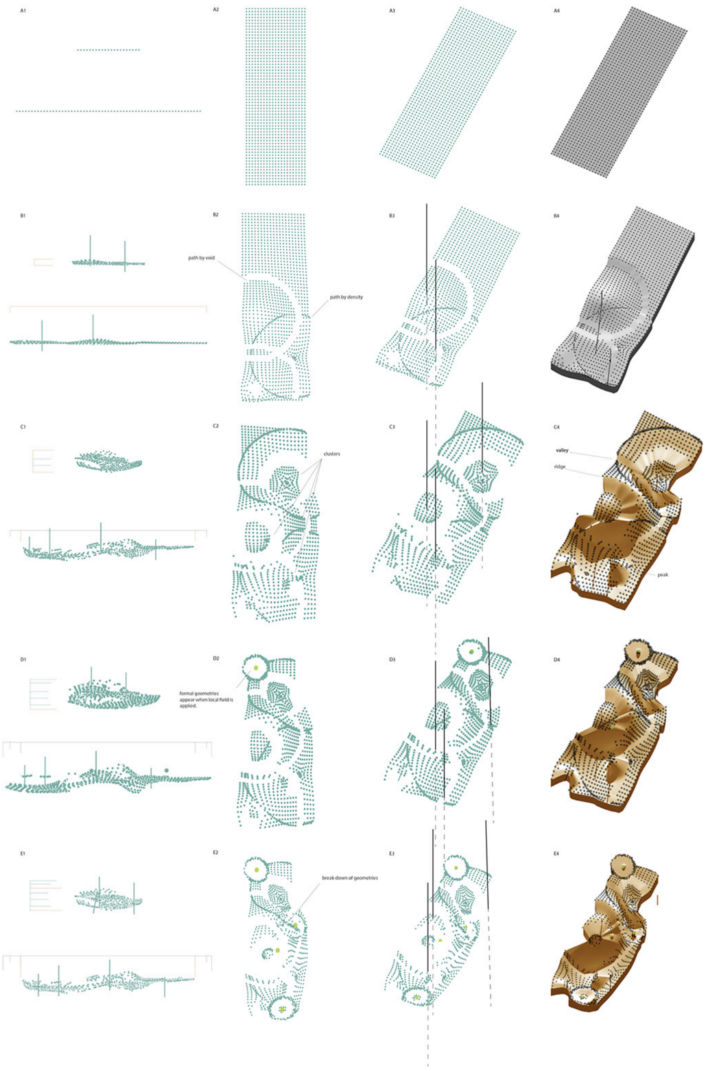

Figure 5: Morphological Terrain (R. Wooten, 2014)

As the progress of the systematic studies and contextual analysis develop into a more cohesive narrative, implementation of events gain exposure. Rather than describing the project through a strict and definitive development program, the sites of inquiry are boosted with a more rich operational narrative of plasticity. Like we have seen from projects such as Rem Koolhaas' Parc de la Villette (1982) and Plasma Studio's Xi'an Flowing Gardens (2011), negotiations between the ontological system, ecologies and existing conditions provide support for an infiltration of urban events which shall establish opportunities of future growth, elasticity, and extensive sequencing. Growth here does not imply traditional phasing units. On the contrary, parameters will inform a new space of propagation and possibility to self-organize. The informed event resultants define a local conditional transformation of internal logics just as the earlier ontological not-to-scale models postulate. The particularities of research, which includes the contextual analysis and methodical modulations, must take part in the proposal processes of our future built environment.

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About the Author

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Jeffrey S Nesbit holds a Master of Architecture from the University of Pennsylvania and a first Master of Architecture from Texas Tech University. Currently, his work investigates urban organizational strategies based upon the generation and evolution of topological behaviors. In particular, evaluating the analysis and synthesis of phase transitions through the oscillating tissues of an interconnected urban fabric. In addition to directing the experimental architecture group Haecceitas Studio, he is an Assistant Professor in the College of Architecture at Texas Tech University teaching various graduate design studios and urban theory seminars including an architecture studio in Seoul, South Korea.

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On Biogenous Systems: symbiotic relationships, sustainability, and an inquiry on the foundations of a complex systems culture

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Abstract: A biogenous system is a complex adaptive ecosystem where living organisms provide for other living organisms. The focus of this paper is a biogenous system currently being developed for urban/suburban built environments. Described is an extension to the low-cost process for architecturally integrating microbial ecosystems originally outlined in *[En]coding Architecture : The Book - Algal Architecture: Incorporating Biological Symbiosis*. Implementing this process has the potential to close open energy loops by the onsite production of refined biogas - using algae photobioreactors and anaerobic digestion - and to foster a symbiotic relationship between humans and microorganisms. Furthermore, the paper presents a point of view regarding issues of implementing biological systems in the built environment and on the larger notion of a change in the physicality of human habitats. This point of view is developed through inquiry into the foundations of complex systems culture in design and how complexity theory can help identify sustainable systems. With these foundations laid out, the paper analyzes the current biogenous system. The analysis focuses on the biological elements, speculating about the interactions between elements at different levels, from microbe to city, and their sustainable characteristics. The aim of the analysis is a better understanding of issues with implementing complex adaptive ecosystems like the biogenous system described, the sustainability of such systems, and the impact implementation could have on the human habitat.

Keywords: Architecture, Sustainability, Algae, Anaerobic Digestion, Systems, Design

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Biogenous System

[baɪ oʊ dʒɛ nəs sɪs təm]:
n. A system characterized by
producing or being produced
by living things.

1 Challenges

Our global society and its challenges set the stage for this research. We face challenges like never before. Status quo systems for energy distribution on this planet are artifacts of a belief in a static and deterministic world. As such, there is an inherent lack of sensitivity to socioeconomic forces. This is evident by the disparity of access to resources and the extreme economic inequalities. These systems are open loops producing negative externalities like emissions and waste.

1.1 Genesis, Inspirations, and Methods of the project

If, as Liss Werner writes in *[En]coding Architecture: The Book*, “The architect is no longer an organizer of matter and space but a designer of systems - with multi-layered components and complex relationships” then an understanding of complexity and innovative applications of technology are more important now than ever. The article *Algal Architecture: Integrating Biological Symbiosis* appears in [En]coding architecture. In it, Jacob Douenias suggests a low-cost process for integrating biological symbiosis into buildings. The biogenous system he describes was the genesis for The Biogenous Project, a research company that Jacob and I co-founded with colleagues and classmates from Carnegie Mellon University’s design, architecture, and mechanical engineering departments.

Our mission is to explore the possibility of incorporating biogenous systems into our buildings as processes that synthesize or manipulate energy for closed-loop living. Systems thinking is prevalent in our designs and methods that implement them. We draw our inspiration from biomimicry; we want to add lungs, stomachs, and intestines to our buildings. In addition, we’re inspired by recent implementations of algae photobioreactors in the facades of buildings and the use of anaerobic digestion for methane production at wastewater treatment facilities across the globe.

2 Description of process

The biogenous system described in this paper is an artificially contrived biological process that mimics the filtration of biogas through algae ponds. It is composed of subsystems, namely, anaerobic digestion (AD) of organic waste into biogas by methanogenic bacteria and transparent algae culturing containers called photobioreactors (PBR). These subsystems are themselves complex, each process involving metabolic processes with inputs and outputs. In such a system, the waste from each point of consumption is reconstituted as a valuable input to another. Humans, algae, and anaerobic methanogens create a mutually symbiotic, closed-loop system.

2.1 Anaerobic digestion system

Organic waste provides a substrate for a variety of decomposing bacteria that generate biogas. This gas is generated by a series of chemical processes that proceed through stages. Each stage provides the raw materials for the next. The gas output is volatile and complexly coupled related to types of waste. This is an interesting feature of the biogenous system and an example of the systems thinking taken in its design.

2.1.1 Anaerobic digestion outside of the systems culture[1]

Industrial implementations of these systems focus primarily on the treatment of sewage: reducing pollutants (biological oxygen demand), reducing solids. There is no interest in harnessing biogas produced nor using it to generate electricity. The statistics are a disheartening reminder of the lack of mindfulness in the design of the systems with which we coexist.

"Today, the US has over 2,200 operational anaerobic digesters. The majority,1,500, are located at wastewater treatment plants, but only a scant 250 currently use the biogas they generate. This means 1,250 biogas-producing WWTPs could be producing biomethane or electricity, and then there are another 2,000 WWTPs that are completely undeveloped. This is a massive economic opportunity." [2]

Industrial digesters are designed for particular wastes. The biogenous AD subsystem is a departure from industrial practice in that it is adaptive and integrated into the building; it is designed to handle most organic waste, made from up-cycled parts, at low costs. It is the mechanized stomach and intestines of our biogenous system.

2.1.2 I/O and feasibility of implementation

The subsystem produces outputs. Liquid effluent is discharged periodically and is a valuable fertilizer[3]. Additionally, spent solids are discharged. This output is valuable and can be used as compost with minor manipulations. Interactions with the digester are minimal, yet vital. In developing countries, the low-energy flame produced by burning biogas would increase quality of life significantly. Developed countries enjoy an ease of use and availability from their energy infrastructure. AD energy must be comparable if costs for implementing this biogenous system are economically worthwhile.

2.2 Algae photobioreactor system

2.2.1 As biogas upgrading systems

Raw biogas produced by the biogenous system is filtered by PBRs. The CO_2 rich gas provides concentrated nutrients to algae which sequester the CO_2, leaving behind a cleaner-burning biomethane. Biogas is stored onsite in variable-gas containers, or compressed then

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1 By systems culture I'm referring to the practices and approaches of designers and thinkers that acknowledge the importance of systems thinking. A quote from Complexity Theory for a Sustainable Future captures this saliently:

> "A world-view of nature and society as rather static and predictable systems must be replaced by a view which emphasizes continuous change and uncertainty. This dynamic view is a prerequisite for better management of complex adaptive ecosystems, so that they can continue to supply the goods and services human society relies upon. "

2 This statistic appeared in *Anaerobic Digestion System to Provide Pipeline Quality Gas*. A biogenous system that was coupled with sewage drainage from buildings could simultaneously reduce the biological oxygen demand of waste and the volatile solid content of sewage leaving a building.

3 The following is a title of a 45-page document from the Food and Agriculture Organization of the United Nations "Bioslurry = brown gold?"

stored; an appropriate method is dependent on socioeconomic factors. The promise of this system is in providing avenues for creating biofuel, producing heat, shading buildings, and reducing street noise.

Moreover, the biogenous system is incorporated holistically within a building, providing aesthetic value from photobioreactors and energy to drive processes like heating, cooking, and possibly onsite generation of electricity from biogas or synthesis of biodiesel from algal biomass. This is how the biogenous system is capable of producing energy from biological processes.

2.3 Automated regulatory systems

Digestion is a complex process. Heat is necessary for reactions, and the biogenous system responds to changes by routing energy from the sun to the digester via solar heaters. Adaptively promoting homeostasis of the system. The temperature and pH of the reaction is adjusted by computer models that interact with the subsystems via sensors and actuators. The algae is also regulated by computer models that relate the density of cells in photobioreactors to algal population, adjusting media accordingly and even draining and routing dead algae for oil processing, or, as in our current biogenous iteration, right back into anaerobic digestion.

3 An inquiry into foundations

The intent for the biogenous system is for it to be a self-regulating and sustainable ecosystem. What follows is an inquiry into complex systems themselves, especially ecosystems.

3.1 Complex systems and sustainability

An ecosystem is a complex system. Like the biogenous system, it is composed of parts that interact with each other nonlinearly. All systems are hierarchies with higher-level systems made of lower-level ones. In the biogenous system, microbes at the cellular level are aggregates of smaller units, e.g. organelles. The benefit of this sort of conception is that units can be understood as agents, or nodes, taking from the environment inputs of energy necessary to ensure self-survival. At each level, agents interact with one another locally producing local consequences. However, emergent properties of each level have non-linear effects with other levels.

The lateral effects of local interactions are a real consideration for the architect designing biogenous systems, e.g. feeding a digester or neglecting it, lead to dynamic change in the entire system. Mistreatment of the biological elements can lead to systematic failure across all components. Ultimately, there is interplay between the adaptive responses of individual agents, like microbes, and the emergent properties of the whole biogenous system, e.g. energy production.

Therefore human agents must interact locally with their biogenous system by inputting organic waste to keep it running. At a higher level, this interplay means humans have vested interests in the biological health of their buildings. This interest goes beyond a fear of asbestos or the building’s aesthetic value. It is a new intimacy with the building.

3.1.1 A dialogue between complexity theory and sustainability

The biogenous system was developed with sustainability as a pervasive feature of its design. We wanted sustainability to be an emergent property of the interplay between the adaptive responses of the anaerobic digester, the photobioreactors, and humans. Sustainability definitions traditionally imply a system is to be maintained at some fixed point, indefinitely. Understood this way, there is no rampant growth, but at the same time there are no nullifying processes. There is no death. This naive notion does not account for renewal processes in nature. Things die. Sustaining systems beyond their natural cycle just increases the load on higher-level systems (Voinov, 2007). Any sustainability analysis for biogenous systems then must focus on renewal processes and system resilience, i.e. the ability of a system to continually adapt.

Sustainability as a property of systems can then be incorporated into the design by seeking out processes with natural cycles of renewal. With this method, the architect has the ability to move up the hierarchy of systems to examine the various renewal processes embedded at different levels, assessing their resilience and emergent properties.

4 Sustainability of the biogenous system

4.1 Transforming buildings from units of consumption to units of production

Our buildings are consumers of energy. The biogenous system makes a building 'biogenous' in that it transforms it from a unit of energy consumption to a unit of energy production though the use of microbial subsystems. The biogenous system architecturally recodes buildings, redirecting dissipated energy. At a lower level, the interplay between the algal systems, the flora of the digester system, and humans, is a symbiotic relationship that creates greater autonomy in higher-level systems. A greater resilience to change becomes an emergent property for any biogenous building since it is fundamentally more energy-independent. Communities of biogenous buildings then are also collectively more resilient, improving their sustainability.

4.2 Renewal and resilience

On a higher level, the biogenous system affects the behavior of neighborhoods. Homes, schools, and restaurants, suddenly become nodes that no longer dissipate all their energy in an open loop, possibly damaging higher-level hierarchies like the global climate. Instead they dissipate energy in a way conducive to maintaining their resilience.

There are inevitable nullifying processes, e.g. overproduction that cause infrastructure damage, or natural disasters. Moreover, biogenous systems might provide resilience to changes in energy access like the wake of disaster. This has positive implications for natural disaster relief.

4.3 Speculations

On this neighborhood level, the units are sectors of a town. Here we make an effort to understand the relative distributions of energy across neighborhoods. As a systems designer, the architect imagines a whole range of possible adaptive systems solutions in line with a systems culture. Take for example technology that can help foster self-regulating behavior at this level. Big data and computational modeling are powerful tools for the emergence of intelligent energy grids in our cities, adding a layer of adaptability at this systems level[4]. Surplus energy dissipated by dead nodes or over-productive ones can be reallocated to other places. Metaphorically, the whole urban environment becomes alive, in that it moves energy from subsystem to subsystem in its network, (much like an organism's metabolism) learns from data such as usage patterns, and adapts. The biogenous system is a sustainable upgrade on many levels because it promotes the resilience of nodes through the hierarchy, and is composed of subsystems that are themselves renewal processes.

4.4 Change in physicality and hopes for the future

There may be more biological elements that we can incorporate into a biogenous system, or less even. The idea is to leverage biological tools in the architecture.

It was mentioned that this architectural intervention seeks to foster biological symbiosis between microbes and humans. It could have the potential to change our relationship with the environment fundamentally. A human relationship with microbes is not an impractical or idealistic aspiration. Even in our own bodies, we've co-evolved with microorganisms.

> *"By living within a closed loop, [biogenous] users have a benefit of immediacy, control, and the ability to take responsibility for their resources."*
> *(*Douenias, 2013)

I believe this to be the most impactful aspect of the biogenous system. At a very high level, the biogenous system is a system designed to codify man's relationship with his environment. The introduction and adoption of technology, e.g. the car, has systemic effects on society. Adopting biogenous systems is no different. Instead of driving us along to a future where technology fixes all of our problems, the biogenous system has the potential to drive change in the civil character of man himself, from mindless consumers of energy to a mindful symbiote of the natural world.

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[4] From Carnegie Mellon's big data for sustainability seminar: IBM has initiatives for "smart" green buildings with adaptive energy management.

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Architectural ecologies: code culture and technology at the convergence

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Abstract: *Architectural Ecologies: Code, Culture and Technology at the Convergence* investigates architectural interfaces between system theory, computation and biology. It focuses on processes that are described as an alloy, opening up possibilities for conceiving a para-digital architecture where computational matter becomes the catalyst of an extended understanding of architectural formations in material and virtual space, embedded in a field of parallel interactions with and between natural, cultural and technological systemic ecologies.

Keywords: Evolution; Code; Urban Organisation; Computational Ecologies; Para-Digital Architecture; Communication; Form; Material; Culture;

> *"It is also not about having the computer create a large number of proposals from which to choose. It is not about using computers to create unusual forms. When used like that, a computer becomes nothing more than an extension of the pens in the hand. It is about using computers to think, as an extension of the brain." (Watanabe, 2002)*

Starting with a brief insight into *Code as Computational Ecology*, the paper discusses the role of code during the shift from a *desire to object*[1] towards an emerging data and information fetish. *Code as Material of Distinction* reviews known forms of architecture as codes of communication (Shannon, 1949) and distinction (Brown, 1969) alike and looks forward to the impact of obvious intricate protocols for program. *Relational Systems,* part three of the paper, discusses the making of architecture through code, conversation and as learning and living system.

Architectural Ecologies operates on the level of adopting sound material, fabrication and coding knowledge and pairing it with emerging theory and philosophy to arrive at an architectural culture that "embraces a multi-ordered cybernetic model[2] of and for the new world owing a multitude of facets, classes of information (data) and ways of learning." (Werner, 2014 (not published yet)).

1 Code as computational ecology

Architecture has been dramatically transformed by the advent of computational tools, leading towards a change that Antonino Saggio defined as the "informatic revolution in architecture" (Saggio, 2007). The widespread adoption of computational tools and digital technologies allow the architectural design process to shift into the virtual realm, and bringing the focus from designing artefacts and objects towards designing methods and strategies. The new material consists of complex data, data-flows and "calculus processes" (Lynn, 2005) constructing new possible generators for architectural (in)form(ations).

Since in the late twentieth century virtual and material reality merge to take on the form of code, architecture challenges the development of its own expertise at the understanding and description of structures as systems (living and non-living, virtual and material) in a spatial-temporal evolution. A critical understanding of this construct is required to enable the design of design strategies for apparent complexity. Thus the debate targets the deep impact of system theory as culture, and simultaneously describes a frame for para-digital, namely biological tools such as code to become an element that allows for the understanding of urban and natural systems as a whole.

> *"I believe that architecture in the future will be characterized by an increased participation of the user in its organziational and formal definition. […] Contemporary architects must do everything possible to make architecture less and less the*

[1] *desire to object* refers to an object and form driven design methodology, that is mainly concerned with aesthetic values and beauty, disregarding broader, cultural, economical or spatial implications – holistic values.

[2] A model is defined as the representation of reality or a part of reality. 'Reality' is defined according Heinz von Foerster in 'Constructing Reality'. Reality is a phenomenon constructed by the observer through the memories and codes embedded in the observer. One can refer to 'reality' as personal bandwidth and to a model as the representation of personal bandwidth.

> *representation of its designer and more and more the representation of its users." (De Carlo, 1980)*

The paper opens up a discussion on self-organising organisms structurally based on circular observation, and feedback and learning in architecture as theoretical framework for research on e.g., urbanity systems. Departing from object driven architecture also means departing from an object / material focused culture and ecology. If we do define ecology as a study or phenomenon of interactions between entities in a space and their relationship to environment and Umwelt[3], we may want to consider that code (may it be digital/binary or cultural/semantic) is necessary for (re)configuring an otherwise unstructured pattern.

2 Code as material of distinction

A distinction has to be made, for architecture to occur, and for allowing constituting whatever will be constructed as architecture and whichever means are being used to communicate about architecture.[4]

The code of architecture as material of distinction may be traced back to Alberti and Vitruvius, differentiating the inside and the outside, the function of each element in the house as general typology and its tectonics - construction per se and the technologies applied (Frampton, 2001).

Today, the wide-spread research into computationally-driven digital fabrication technologies, including robotics (Ferringa, 2012) (using code) coupled with an increasing understanding material behaviour beyond pure structural properties has given strength to a novel approach to architectural design, that allows for the production of models with precise fabrication and assembly information embedded in their protocols. The architectural form is understood as a complex diagram of forces (Thompson, 1961) is determined through the interaction between internal body-plan and a set of environmental pressures shaping the plastic expression of this organizational logic. This can on one hand be seen through Ashby's cybernetic note on e.g., *Richness of Connexions* (Ashby, 1957) and his statement on structurally determined organisms showing only a vague distinction between the organism and the environment (Ashby, 1954) and on the other through research in biological architecture suggesting the use of proteins, cell and tissue material.

Apart from relating architecture to physical material, the paper also investigates into architecture and societal systems as coded models for spatial configuration. The case study 'Spatializing the Social' "proposes a set of architectural and urban strategies […] for interventions in informal settlements, informed and empowered by the use of computational tools for […] simulation." (PanahiKazemi, 2013). The project 'SWARM' on simulating drones as work force for building, on the other

> *"is intended to show the use of computation for a design problem that is persistent but in flux, and time-based. The use of data, static and dynamic, to inform all minute decisions and response on the Agent's part is designed to create a directed series of behaviors to create the object that solves the problem.*

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[3] The notion of Umwelt relates to Jacob von Uexküll (1864 – 1944)

[4] Refer to D. Baecker, 'Dekonstruktion der Schachtel: Innen und Außen in der Architektur', in N.Luhmann, F. D. Bunsen, D. Baecker, *Unbeobachbare Welt: Über Kunst und Architektur*. Bielefeld: Haux, 1990, pp. 67-104.

3 Relational systems – the new architectural ecologies

Informed by Manuel DeLanda on materialist ontology (DeLanda, 2011), Neil Spiller on the new post-digital cyberspace (Spiller, 2009), and following tangents found in Donna Haraway's notion on post-humanism or Christine Boyer's CyberCities, et al., the theoretical development offer the possibility to reevaluate the concept of ecology as social and philosophical agency. The emphasis on relational systems becomes increasingly relevant through Latour's actor-network theory[5] (Latour, 2005), where relationships become the foundational elements of the expression of individual entities, understood never as static systems, rather as dynamic becomings defined by the relationships that they construct with other entities, being them living or immaterial.

The paper offers the possibility to reevaluate relationship between form and function, between unitas, firmitas and venustas towards a new synthetic understanding of code, culture and technology at the convergence.

> *"Architecture as organisation of societal difference has reorganised its syntax from a rational clear structure to a self-organising body breeding spaces for aggregation, physical and virtual. Architecture herself offers the potential of bio-semiotics, leaves the mere paradigm shift behind to enter a still untouched terrain." (Werner, 2014 (not published yet))*

'Architectural Ecology' embraces and follows Ludwig von Bertalanffy's "principle of emergentism and […] asymmetricm" (Hofkirchner, 2005) as described in 'General System Theory' (Bertanlanffy, 2003) towards a twenty-first century Turing machine.

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[5] Latour's 'Actor Network Theory' is a direct descendant of Gordon Pask's Covversation Theory (CT - see 'Conversation, Cognition and Learning', 1975). CT applies to learning in general, and statistical in particular

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Werner is a licensed German architect, Assistant Professor at Anhalt University, DIA, Dessau, George N. Pauly Fellow 2012 (Carnegie Mellon University, Pittsburgh), and the editor of *[En]Coding Architecture - the book*. Werner practiced in the UK, Russia and Germany, lectured, spoke and exhibited internationally at MIT, CalArts, University of Southern California, Texas Tech University, The Bartlett, TU Berlin, Syracuse University, Kunstuniversität Linz, Tongji University, Venice Biennale 2012. Her research focuses on cybernetics + architecture investigating in the current discourse of computational architecture towards a relationship focused discipline. Werner chaired *[En]Coding Architecture* at CMU, EXP at Florida International University (Miami), EPFX at SciArc (Los Angeles) and *Architectural Ecologies* (Vienna). Werner holds a Ba(hons), Diploma of Architecture and Master of Architecture from the Bartlett. Further she studied at RMIT, is a member of the American Society of Cybernetics and a researcher at Humboldt-University, Berlin.

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II A 2
Sustainability, ethics and the cyberspace

Chairs

Stefan Strauß, Institute of Technology Assessment, Austrian Academy of Sciences
Tomas Sigmund, Department of Systems Analysis, University of Economics, Prague
Tomas Karger, Department of Sociology, Andragogy and Cultural Anthropology, Palacky University, Olomouc

The variety of current and emerging societal challenges underlines the demand for new concepts towards sustainable ways of living. While sustainability primarily addresses environmental issues, this symposium asks for wider (ethical) perspectives. The extensive diffusion of ICT and the embodiment of cyberspace triggered a variety of societal changes that penetrate all aspects of societal life. New, easy ways of information spreading are accompanied by increasing complexity, diversity and diminishing boundaries between the public and the private sphere as well as the social relations in-between. ICT opened up a wide range of new possibilities for the realisation of human potential, but at the same time affect society in a way that challenges the common grounds of social relations and perceptions of good living in an ethical sense.

List of Contributors

Stuart Armstrong, Vincent C Müller: Total surveillance: everybody watching everybody else
Gerhard Banse: Sustainable development: technology: culture: remarks to their relationships – Abstract with Distinguished Lectures Section
Vladimir Arshinov, Vadim Chekletsov, Pavel Luksha: IoT & Neuronet: ethical issues of intersubjective and interobjective hyperconnectivity
Tomas Karger: Open-source communities in cyberspace: transparency, knowledge production and sustainability
Georgy Ishmaev: On the ethical justification of privacy
Tomas Sigmund: Ethics at the crossroad?
Judith Simon: Relating and disentangling surveillance and privacy
Stefan Strauß: Digital identities as a metasystem transition: lost in conflation or towards sustainable privacy protection?
Linnet Taylor, Dennis Broeders: Drones for development? The shift from observation to surveillance in the international development field
Robert Trappl: Ethics for robots or Asimov revisited – Abstract with Distinguished Lectures Section

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Total surveillance: everybody watching everybody else

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Abstract: Technology is driving surveillance towards everybody watching everybody else. Is this an actual development? Is it avoidable? Is it a risk for humanity, or does it perhaps provide overwhelming benefits?

Keywords: Privacy, Sousveillance, Superveillance, Totality, Überveillance.

1 Total top-down surveillance

Classic surveillance is top-down, from the more powerful to the less powerful. Top-down surveillance has increased in the past decades, largely due to technological developments in the increase in personal digital data generation (sensors + digital life), the growing ability to collect and store this data, and improved computer processing (hardware and algorithms) that can process this data and make it available in useful form for humans (e.g. visualised). Surveillance is accepted as the price of convenience - but also generates resistance and emphasis on 'privacy' (the ability or right to control information about me). Acceptance and resistance is highly culture-relative and in flux.

In order to distinguish activities that are purposeful for surveillance (like following a person, or installing a 'bug' in a room) from activities that are carried out for other purposes (like selling a mobile phone or controlling car tolls) but generate data that allows surveillance by machines (Müller 2009), some people have used the term Data Surveillance, or Dataveillance (Clarke 1988). The current culmination of dataveillance is an 'Überveillance' (Clarke 2010), what used to be called 'total information awareness', where we get the impression that pretty much all data on everyone is surveilled by someone (e.g. Schneier 2013).

2 Total surveillance

Top-down surveillance in its various forms and aspects is the subject of classical surveillance and privacy studies. We want to take a different perspective. It is now sometimes suggested that the asymmetric information flow of classical surveillance can be countered by surveillance from the bottom up - sousveillance (Mann 2013, Bakir 2013). Sousveillance makes use of sensors on people, e.g. portable cameras and wearable computing to control state agents, to bring surveillance to our attention (Zuckerman 2013, Schneeberger 2013) and assure freedom of information (in the same vein as 'Wikileaks'). Surveillance is becoming easier for everybody, for classical top-down surveillance (e.g. by state agents or businesses) for surveillance from the less powerful to the more powerful (sousveillance) and horizontally, between agents of similar power levels (institutional agents or people). Our working hypothesis is that surveillance and sousveillance will be joined by what we propose to call "horizontal surveillance", i.e. the surveillance from one agent to another on the same power level. This might be from one corporation to another, e.g industrial espionage, or from one person to another. The three major factors (data production, data access, data analysis) that have pushed surveillance and, to a lesser extent, sousveillance, will now also push horizontal surveillance. Overall, we are heading towards a society of total surveillance of all by all, a panopticum in which not only the guards see the prisoners (surveillance), and the prisoners see the guard (sousveillance) but also the prisoners see the other prisoners (horizontal surveillance).

We will investigate how technology drives this development to an extend that it seems very hard to avoid, but also what unexpected merits it might bring – together with the end of privacy.

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IoT & NeuroNet: ethical issues of intersubjective and interobjective hyperconnectivity

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Abstract: Internet of Things as new level of global network unfolds emergent issues of more complex interfaces design: mind/mashine, mind/environment, mind/body and mind/mind ones. This paper deals with some findings of socio-cultural and philosophicall discussions on the “IoT” and “NeuroNet” foresights held during 2012-2013 years in Russia.

Keywords: NeuroNet, Internet of Things, complexity, foresight, ethics, human enhancement, STS, converging technologies, cognitive science, human machine interfaces, IoT, IoE

Acknowledgement: This work was possible due to grant № 12-03-00625 of Russian Humanitarian Science Fund

Internet of Things concept presumes a next level of transparency and pancommunication with new mind/mashine, mind/environment, mind/body and mind/mind interfaces. Adequacy of agents in concrete situation depends on awareness and response-ability:

- Awareness of my own stream of consciousness
- Awareness of my body condition
- Awareness of time and space
- Awareness of others
- Choise between alternative reactions
- How to react? And why?
- With whom to interact? How? And why?

For each of the above-listed options we have possible IoT&Neuronet-based modus operandi. (Big) data streams from EEG, body, home, technosystems and environmental sensors, RFID, AR, GPS, lifelogging etc. information help on the one hand for better orientation in world complexity. On the other hand this can cause digital intoxication and lack of Sense. So we need media-detox and broader- media-culture contextualisation. However meaningful action have to be induced not only in rude “practical” way, but in more complex inclusion of aesthetic dimensions for example, personal values, mystic modes etc.

And interfaces design have to consider emergent co-evolution of agents and their environment and to be flexible enough for online inclusion of concrete communication to more complex context as subsystem. And how to implement of complexity paradigm in human enhancement issues? We propose the transdisciplinary view on mind and body extension, where classical intersubjectivity problem has to be re-read in context of mutual understanding of natural intelligence and AI. For Self/Self, Self/Other and Self/Environment communication we consider specific fractal interfaces. For this interfaces the complexity-observer is reflective obsever of self-organised “partial observers ensemble”, wich includes himself as order parameter. Such a observer cognition is embodied and situated. Further, convergence of Human Enhancement and Ambient technologies (Internet of Things, Augmented reality and other Hybrid Environment and pancommunication trends) makes possible to create certain layer of reality (of city landscape for example), representing certain mode of our corporeality as emerging process.

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Open-source communities in cyberspace: transparency, knowledge production and sustainability

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Abstract: Knowledge production is not limited only to individual minds, but takes place also through interaction in communities. Communities in cyberspace can be distinguished on online constituted and online facilitated. I will present open-source communities as knowledge producing communities constituted by their presence in cyberspace. Online constitution brings with itself possibilities leading to a level of transparency not experienced outside cyberspace. The main question tackled in this paper is: what is the relationship between knowledge availability and knowledge production in parts of cyberspace where knowledge is produced and stored transparently? The main point, based on my research on open-source communities, is that the importance of attention as a resource grows in the parts of cyberspace, where knowledge is freely available. Considering attention as a differentiating resource forms a perspective that can be aligned with Luhmann's system theory and upon which further research can be based to understand how communities are able to sustain themselves in an environment, where the mutually reinforcing relationship between available knowledge and new knowledge would logically lead to indefinite escalation of pace and scope of its production, which would place impossible demands on the communities themselves.

Keywords: Knowledge production; cyberspace; open-source; communities; transparency; attention;

Knowledge is usually produced in the course of problem-solving. This establishes its relation to the concept of intelligence (Heylighen 1999:2). However, this process may not be limited to taking place within an individual mind. It is nothing radically new to conceptualize collective intelligence spanning number of individuals (Wechsler 1971). As opposed to mass intelligence, collective intelligence can be defined as a process of communication, in which the individual actors mutually operate as critical evaluators of meaning (Uspenski 2013). Resulting from this process is an information considered valid for the given problem – knowledge.

Through repeated interaction actors form communities. However, as Cantoni and Tardini argue with regard to the presence of communities in cyberspace, it must be distinguished, whether they are constituted online, or only facilitated. This difference emphasizes, whether the focal point of the interaction lies in cyberspace or not (Cantoni & Tardini 2006: 159). In my argument, I will present open-source communities as knowledge producing communities constituted by their presence in cyberspace. Open-source communities gather around the development of technical objects which not only require but also represent specific kinds of advanced knowledge. In these communities, non-uniform distribution of knowledge is present, which provides an incentive for individual actors to cooperate. This cooperation usually takes the form of self-organization (Crowston et al. 2007; Karatzogiani & Michaelides 2009), that is similar to the “post-traditional communitarian structure”, a term that Karin Knorr Cetina devised to describe the conditions of scientific knowledge production (Knorr Cetina 1999). This is not surprising as Pekka Himanen argued in the past that open-source software development bears particular resemblance to scientific production of knowledge (Himanen et al. 2001: 68).

With regard to the process of knowledge production, online constitution brings with itself one peculiar condition. As Yochai Benkler argues, cyberspace makes possible peer production on a scale not witnessed outside of it. This, in turn, translates into a high level of transparency specific for this mode of knowledge production (Benkler 2006). However, given that the non-uniform distribution of knowledge provides an incentive for actors to cooperate and that the transparency results in knowledge being uniformly accessible, we need to ask how could the knowledge producing communities exist in such a transparent environment?

To answer this question, we need to examine learning, the process of transferring knowledge. According to Michael Reay, learning is facilitated by new experience or further reflection of the present one (Reay 2010). Both ways require investments in terms of attention. This is consistent with Stehr’s and Ufer’s claim, that “the acquisition, dissemination and realisation of knowledge requires an active actor” (Stehr & Ufer 2009). Thus, even if knowledge is produced and stored transparently, that does not necessarily mean non-uniform knowledge distribution ceases to exist. Available knowledge does not equal acquired knowledge.

From this line of reasoning, the key question emerges: what is the relationship between knowledge availability and production of new knowledge in parts of cyberspace where knowledge is produced and stored transparently? Based on the data from my own research on open-source communities, I can tackle the question in three steps.

First, knowledge transparency means that the production of knowledge is recorded and thus traceable, making available further new knowledge. Wikipedia is not the only case in which past versions of pages and discussions concerning alterations are stored. Open-source communities use version control systems to record changes made to the source code, bug tracking systems to record various issues and problems, mailing lists and IRC chat to provide infrastructure for the ongoing interaction. All these platforms and their contents are open to read for anyone and so the history of knowledge production in open-source projects is public. However, while mailing list threads and IRC chat logs are often archived by the projects “as is”, version control and bug tracking systems are managed (and, to a certain extent, histories can be rewritten) in order to provide practical utility.

Second, knowledge transparency implies that resources required to attain knowledge are widely distributed among the population. We must bear in mind that this is valid only in countries which have bridged the digital divide (Norris 2001), that means in countries where owning a computer and having internet connection is nothing extraordinary. The paywall is then significantly lowered when knowledge is publicly available in the cyberspace. As a result, knowledge is not only more accessible, it is also more discoverable.

This brings us to the third step, postulating that cyberspace, as a transparent environment, creates conditions in which the importance of attention as a resource grows. When overwhelming amount of knowledge is publicly available, the crucial question is what should one focus on? Attention, already mentioned as an important resource for transferring knowledge, is key in structuring the shape of cyberspace. Its scarceness is the root of the information overload problem and its distribution is the solution. In an environment where knowledge flows freely, attention (and its allocation) serves as a structuring force.

From this perspective, we can approach the cyberspace and its ambiguous characteristic of transparency in terms of Luhmann's systems-theoretical thinking (Luhmann 1996: 34). Transparency brings with itself heightened availability of knowledge. The relationship between available knowledge and production of new knowledge can be characterized as self-referential and as a result, the more knowledge is available, the more new knowledge can be produced, which in turn becomes available. The logic of this self-referential relationship seem to be implying indefinite escalation. However, such escalation does not empirically take place because attention, the second ingredient required for knowledge production, is not part of this mutually reinforcing relationship and remains scarce. Thus, attention seems to be the limiting and differentiating resource when transparency yields large-scale knowledge availability. Therefore, in order to understand how the knowledge producing communities are able to sustain themselves in the transparent parts of cyberspace, we need to examine the cultural and technological practices that regulate the allocation of attention and thus leave some of the clarity provided by transparency redundant.

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On the ethical justification of privacy

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Abstract: The gap between practices of data collection and established ethical norms sometimes may be called scandalous. The task of bridging this gap is a huge challenge for ethics and involves separate issues such as what privacy is, what its value is and etc. These are not purely theoretical issues. Problem of the ethical justification of privacy is crucial for the formulation of concrete guidelines and recommendations for legislation. In this abstract several approaches to the ethical justification are considered, both from the perspectives of practical application and further research on normative ethics.

Keywords: Privacy; Ethical justification; Discrimination; Autonomy; Normative ethics.

There is a wide specter of views regarding the ethical value of privacy including a radical skepticism on whether privacy can be granted the status of moral value. It is not hard to dismiss such radical claims since privacy has now gained an established status both as an empirical issue and as a legal norm. Nevertheless, this line of criticism demonstrates the point that the value of privacy is indeed often justified on the basis of other ethical values. In general, there is currently no consensus on the moral justification of a right to privacy. Sometimes it is construed as intrinsically valuable, sometimes as deriving its value from other sources such as freedom and dignity etc. This ambiguity is not a purely theoretical issue. Problem of the ethical justification of privacy is crucial for the formulation of concrete guidelines and recommendations for formalizing legislation. In order to clarify what the limits of privacy are we need to have a clear understanding of the value of privacy.

1 Approaches for the ethical justification

Van den Hoven (2008) provides a substantial classification for a range of alternatives for the ethical justification of private data protection. He distinguishes information harm, information inequality, informational injustice and moral autonomy. Information harm regards security issues such as theft or other criminal acts that may be committed because of the private information breaches; information inequality involves issues of commercial value of private information. These aspects of privacy protection while being extremely important nevertheless fall into the scope of standalone legal issues such as information security and copyrights, and therefore do not provide a general base for the moral justification. Informational injustice and moral autonomy on the other hand deserve a closer look.

1.1 Discrimination avoidance

Quite often, protection of privacy is justified as a mean of protection against discrimination or protection of dignity, issues that may be generalized as an informational injustice. It is safe to say that such approach is currently the most developed one in the field of applied ethics. Indeed in medical ethics, bio-ethics and sometimes even in broader field of data mining privacy protection is explained as a mean to avoid discrimination. Such approach gained its popularity for a good reason. Counter discrimination laws are well developed in EU therefore development of new privacy protection legislation and its adaptation to existing laws is more feasible on the basis of given approach (Gelert, de Vries, de Hert, Gutwirth, 2013). From the perspective of normative ethics 'discrimination avoidance' approach also has its appeal since it provides a straightforward application of Mill's harm principle. Indeed in regards to the justification of privacy protection such harm as discrimination or dignity harm may seem to be the most evident ones.

However 'discrimination avoidance' has certain shortcomings in an applied field of legislation development as well as in scope of research on normative ethics. In terms of practical application given approach unduly narrows frames of the privacy protection legislation. It is not difficult to think of examples of private data violations such as disclosure of personal communications or Geotagging, which do not necessarily carry discrimination risks and do not cause any harm to dignity, and yet these issues undoubtedly require respective legal coverage.

From the perspective of research on ethics 'discrimination-avoidance' approach also faces certain obstacles. If we try to define privacy as something instrumentally valuable only in connection to other values such as non-discrimination it is easy to assume that privacy has no distinctive moral value and concept of privacy itself has nothing illuminating in ethical or legal sense. Schoeman (1984) calls it a distinctiveness thesis problem. He argues against such position claiming that any reductive account of privacy risks losing some crucial aspects of this complex issue.

These shortcomings of 'discrimination avoidance' approach demonstrate that the development of sufficient account of the ethical justification for privacy may require inclusion of other concepts such as moral autonomy. Some authors argue that unlike legislation for protection from discrimination, laws on the protection of individuality and autonomy are not well developed (Custers, Calde, 2013). I would argue that this is not an insurmountable obstacle. Right for autonomy in fact is a more general notion that includes in itself right for non-discrimination and right for dignity. Forst (2005) defines right for non discrimination as a social autonomy. In his multidimensional account of autonomy he points out that rights and liberties should be justified on the basis of deeper understanding of the concept of autonomous person.

1.2 Right for Autonomy

Van den Hoven (2008) and Nissenbaum (2010) point out a crucial relation of privacy with the autonomy for self determination and construction of self identity. Nissenbaum puts emphasis on the political liberty stating that privacy is crucial for the free political choice and decision making in democratic society. Autonomy of action in her opinion is less solid foundation for the justification of privacy. Nissenbaum assumes that coercion and manipulation that stem from privacy abuse may potentially affect autonomous decision making of individuals but there is no evidence for such statements. I would argue that this issue is more evident than it may seem. Field of commercial data mining that became notorious for privacy violations became a huge industry fueled by revenues from marketing and advertising. It is a quite peculiar fact that contemporary marketing is based on the idea that the promotion of a certain lifestyle to the consumers, which implies consumption of certain goods and services, is much more effective than the promotion of particular products. However until recently this approach was based on rather general approximations about target audiences of these techniques. Huge amounts private data available now through various mining sources open an unlimited opportunity to target individuals with their most intimate thoughts, aspirations, desires and apply tailored marketing techniques. It is not hard to imagine that this may be performed with a great efficiency thus undermining the very concept of autonomous decision making and action. As Mill stated in his work On Liberty:

> *"In the part which merely concerns himself [individual], his independence is, of right, absolute. Over himself, over his own body and mind, the individual is sovereign".(Mill, 1999, p. 13)*

This principle may suffer a serious threat from privacy violations and further development of ethical and legal principles aimed to protect privacy need to take into consideration issues of autonomy. Be it an autonomy in self determination, autonomy in decision making or social autonomy, all these facets of right for the individual autonomy are crucial for the general moral justification of privacy.

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Ethics at the crossroad?

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Abstract: The new virtual environment where every content is immediately available for every user has put us in a new situation. The old concepts are endangered and we are looking for new ones. My article analyses the situation from two perspectives: One focuses on what was lost, the other on what was gained. At the end an attempt to synthesize will be made.

Keywords: Information ethics, public space, private space, cyberspace, hyperreality, technology

Ethics and ICT

The task of ethics or moral philosophy is to reflect and examine moral norms and values of a given society. That also means showing the limits, problems, discrepancies, conflicts and contradictions of a given morality. It breaks its given everyday status which seems unchangeable and obvious. In my article I´ll discuss some conflicts of present morality raised by the era of computers.

ICT present a new environment for ethics. In the era of computers we have been facing new ethical questions and challenges related to computer crime, privacy and anonymity, intellectual property, social engineering, information overload, internet addiction, digital divide, surveillance etc. So far it is not clear how to solve them and if traditional ways of ethical thinking are still relevant. We can trace two intellectual approaches evaluating current ethical atmosphere.

The first group regrets the loss of individual appearance of things, which manifests itself in the loss of the public space, in the loss of meaning in hyperreality and in considering things as disposable. The other stream of ideas stresses the new situation brought by the cyberspace and new definition of old ethical concepts in it. The second stream of thought believes individuality can be kept in the new conditions, but it is not very clear if it will be respected sufficiently. My paper concludes with an attempt to unify these two types of thought – we should evaluate what was lost and try to keep it if it is necessary for the respect of the individual. It is important not to forget technology has a Janus face: its implementation brings both positive and negative effects. Both of these effects have to be considered in spite of their contradictory status in order to fully evaluate the technological consequences.

New environment

The era of computers proceeds from and is the expression of the tendencies and ideologies which were symptomatically described by W. Benjamin. It is based on the idea that with the availability of media content for everybody the content and its understanding changed as well. There arose the possibility for free treatment and production of content which resulted in commodification of media and prevalence of banality.

Our era is not as free as it pretends, the constrains have immaterial and very often voluntary nature, and even if its ideology is unmasked those affected by it don´t seem to take actions against the negative tendencies, but freely choose to be manipulated. Critics of modern ideology are considered elitists and so it is difficult to find a place for contemplation about society. Media support immediacy and leave no place for contemplation. More popular are optimistic tones welcoming everything new.

Critics of the computer age

On the one hand there are thinkers critical to modern ICT based society like H. Arendt, W. Benjamin, M. Heidegger, J. Baudrillard, H. Dreyfus, A. Borgman etc. They criticise the virtuality and generality of modern time and claim ICT and their effects deprive man of something substantial. They claim there is something which is necessary for man to be genuine and if we deprive him of that we don´t treat him appropriately. The man´s substance is not a specific quality, but something like realization of his potential, his freedom, authenticity and respect for the other.

Computers and other instruments of ICT allow infinite reproducibility. The only individuality was closed into the man´s subjectivity which lives its private life. We have lost the sense for public and political (in the original Greek sense). It can be documented on the change the story of Antigona has undergone in the history. K. Kosík (1993) characterized our time as post-heroic. It means that everything heroic is transformed into shallow, pedestrian, small-minded. He continues the thinking of S. Kierkegaard who characterized modern Antigona as isolated and atomised. The power of groups is measured by numbers and not as a relationship of concrete individuals. Isolated individuals form crowds. The situation of modern Antigona is not a tragedy, but unhappiness. And that is why she can´t destroy the misery of modern society. A typical example of modern man is Kafka´s Markéta Samsová who without emotions accommodates to the metamorphosis of her brother in the next room. Any deep emotion towards her brother is impossible for her.

What we lose in computer age is auraticity, respect and understanding for the here and now; at best it is closed in the unique interpretation of the general product. What we need is the sense of obligation for the other which will provide respect, grant him freedom and possibility to realize one´s potential. The conditions man lives in change, but we must always fight for these attributes.

Supporters of the new situation brought by ICT

Other thinkers like R. Capurro, H. Nissenbaum, H. Moravec, R. Kurzweil, M. Eldred, D. Nagel, M. Arnold and others stress the aspect of novelty of the situation where new understanding, new hermeneutics and new ethics is necessary in order to handle the new situation. They are not uncritical, they show new situation including its threats. They try to understand the new situation and use its potential. And for that a new ethics is required. Capurro (2010) suggests a new understanding of our bodies based on digital technologies, opening new possibilities of communication, artificality, privacy, self and subjectivity. The idea is that ethics is to some extent relative to the environment.

What these authors stress is that even in the new conditions the balance is necessary. The world is complex and when one part of it changes, the other parts have to change as well, because they are interconnected. What we must avoid is one-sidedness. No principles and ideas are realised in their pure state; in relation to opposing principles only. The previous thinkers are criticised for being too one-sided. It should be noted cyberspace also seduces to one-sidedness.

New concepts of privacy and publicity

Privacy and publicity must be determined together. One is not determinable without the other. However there is always a cultural influence (including technological development) in their understanding. As individuality steps back into the man´s subjectivity public space changes as well. Individuality is not respected in the outer world and is treated as disposable. However people react to the change. One of the reactions is distrust and creation of fictive identities. People are afraid to enter their real data when communicating with somebody unknown. Their individuality is in danger. If we try to keep it, we´ll have to consider new circumstances. Their individuality will be transformed and maybe more fragmented. People have many roles, are in contact with a lot of others, are available online almost 24 hours and the sense of privacy changes. Helen Nissenbaum in her book Privacy in context (2009) stresses the contextual dependence of private/public distinction and supports the right to appropriate flow of information (Nissenbaum, 2009, p. 127).

Possible synthesis

It is difficult to decide whether the ethical characteristics are eternal or if they change with time. I´d suggest ethical concepts are interrelated, but not every interrelation is equal. The realization of man´s freedom will differ in relation to his environment, but it is important to respect his specificity and grant him space for the self-realization. With that both streams of ideas would agree, where they however differ is the evaluation of various realizations of freedom.

I agree that we must accommodate to the new conditions but that doesn´t mean we have to accommodate to any new conditions. Man can also revolt and disagree with the situation he is put in. If the social situation doesn´t allow the evolution of real relations and respect for the singularity of the other he should refuse it.

To suggest some instructions, we may consider ideas of M. Heidegger and H. Arendt. For both of them the return to the tradition is impossible. Our old concepts and judgements were destroyed in modernity and don´t have their original value and meaning. We can´t appropriate the tradition any more, we can only appropriate our past. Arendt suggests two ways out of the current situation. One is inspired by W. Benjamin and tries to connect past and present and show relevance of some historical concepts in the present time. The lost potential of the past may find actualization in the present. The second way was inspired by M. Heidegger and tries to find impurities in the old concepts and clean them to identify their original meaning. The tradition as a whole can´t be recovered; it must be critically evaluated and moments valuable for the present must be found to illuminate our present conditions. (d'Entreves, 2006)

From that it follows that cyberworld can´t be accepted as it is, that we must question it permanently and support the tendencies which are valuable. Only then we will be able to use its potential. I´m afraid individuality and specificity is not kept sufficiently in current commodified cyberworld.

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Relating and disentangling surveillance and privacy

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Abstract: In my talk, I propose a distinction between three types of surveillance, which correspond to three types of potential privacy violations. I conclude by arguing that any attempt to delimit surveillance and to save privacy must acknowledge these different types of surveillance and their corresponding threats to privacy.

Keywords: privacy, surveillance, social media, NSA, sousveillance

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1 Relating and disentangling surveillance and privacy

In recent years, privacy has emerged as an important topic not only in academia, e.g. in jurisprudence or computer ethics (e.g. Nissenbaum 2004), but also in mainstream media (e.g. Morozov 2013, Cole 2014). There may be at least two major reasons for this increased interest in the topic of privacy. On the one hand, the prevalence of social media usage has led a re-assessment of the boundaries between private and public as well as to reconfigurations of the notion of privacy itself. On the other hand, due to the whistleblowing of Edward Snowden, there have been the recent revelations regarding state surveillance by the NSA and other security agencies. These practices of mass surveillance have revigorated debates about privacy, not only questioning whether the right balance between security privacy has been relinquished, but rather whether the argument that security can be gained by giving up privacy is a sound one, e.g. whether there is any evidence that security has been increased through this mass surveillance (cf. Cole 2014). Given that both privacy and more recently also surveillance have emerged as highly debated topics, the goal of my talk cannot be to provide an overview over contemporary debates on privacy and surveillance. Rather, I want to propose a distinction between three types of surveillance, which correspond to three types of potential privacy violations. I conclude by arguing that any attempt to "save privacy" (cf. Cole 2014) must acknowledge these different types of surveillance and their corresponding threats to privacy.

The first form of surveillance is state surveillance and while the NSA revelations are spectacular regarding the amount of data about citizen's which has been gathered, it should be remembered that states have for the longest time been the primary information gatherers, collecting data about their citizens for centuries (cf. Desrosières 1998, Porter 1995). However, in addition to state surveillance (surveillance I) we now witness corporate surveillance (surveillance II), the data gathering of companies for whose services we pay by providing data rather than paying money. Finally, there is lateral surveillance or sousveillance (Ganascia 2013)– surveillance by our peers (surveillance III). This form of surveillance also is not new, but has been amplified as well as modified through social media usage.

On the one hand, the forms, functions and means of these different forms of surveillance differ vastly: not only are different types of information gathered and processed (e.g. basic information about citizens' birth dates, marriage status or addresses versus media usage data), the interests (e.g. political versus economic) and goals of surveillance (e.g. control, prediction, identification, personalization, etc.) also differ between state-controlled, corporate and lateral surveillance. One the other hand, there are strong interlinkages between these different types of surveillance exemplified by the fact that the NSA accessed data from corporations, thereby merging classical state surveillance with corporate surveillance.

In short, the prevalence and in particular the potential combination of these three different forms of surveillance has rightly led to an increased interest in privacy. New and old forms of surveillance pose a triple threat to our rights to privacy: our privacy towards others users, towards the various known or unknown companies behind services as well as towards the nation states. These types of privacy often are even at odds: the more granular the options for privacy settings are, the more I may share on a specific social networking site. Hence, while these advanced privacy settings may help me protect my privacy with regards to other users, my (lack of) privacy towards the service providers remains unchanged.

Distinguishing these different types of surveillance and privacy is not merely conceptually important, it is also useful for developing means to delimit surveillance and to counter threats to privacy. Regarding state surveillance, legal means are required to protect citizens from undue surveillance by their own states, even if these cannot fully protect from foreign intelligence agencies. Regarding lateral surveillance, we may need to develop new norms of information sharing online to create “private spheres” which enable intimacy as well as freedom, exposure as well as shelter. Additionally, technological solution, e.g. privacy-by-design solutions and privacy-aware default settings should be further explored and embedded into systems design. However, the form of surveillance that appears most difficult to delimit is corporate surveillance. We have entered an era in which people increasingly get - and expect - excellent services without wanting to pay money for them. Instead we increasingly pay by providing our data. Indeed, according to Evgeny Morozov, this “(i)nformation consumerism (...) is a much more dangerous threat to democracy than the NSA.” As long as we want free gadgets and services, we are getting increasingly being monitored. Hence, to counter corporate surveillance we may in the end have to develop new business models as well as a corresponding change of mind.

As a caveat, one should note that while debates about privacy concerns are rightly emphasized nowadays, privacy does not exhaust the realm of problems resulting from mass surveillance. State-controlled surveillance does not only interfere with our right to privacy. It also endangers our basic civic liberties and freedom as it often aims at undermining the potential for resistance and opposition. Corporate surveillance also interferes with our privacy, but is also may create further complications: profiling and behavioral advertising may lead to price discrimination, biased information and increasing distraction and abuse of our attentional capacities (Broadbent & Lobet-Maris 2013). Finally, lateral surveillance or sousveillance through our peers on social networking sites not only affects our privacy, but also influences identity formation and freedom. While social control through peers is nothing new in itself, one may rightly ask how to explore one’s identity, how to change, grow and develop if every utterance is public, trackable and in principle forever available (Turkle 2011).

To conclude: in order to develop strategies for protecting not only our privacy, but also other basic civic liberties, we need to understand the complexities of privacy and surveillance. The distinctions and relations to be outlined in more detail in my talk are meant to support more nuanced debates as well as a more adequate technical, legal, political, and educational counterstrategies to delimit surveillance.

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Digital identities as a metasystem transition: lost in conflation or towards sustainable privacy protection?

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Abstract: The transformation of socio-technical systems in between the stage of convergence between analog or physical and digital environments affects personal information flows and the role of digital identification. In this paper, I focus on the relations between digital identities and privacy. From a system theoretical perspective, digital identification is perceivable as a metasystem transition with increasing amounts of subsystems becoming integrated. This can lead to the emergence of a meta-ID that further strains informational self-determination as a core concept of privacy protection. I discuss the demand for privacy-enhancing approaches with integrated mechanisms to increase the transparency of contextual layers in digital ID processing.

Keywords: technology assessment, privacy, meta system transition

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Stefan Strauß is a researcher at the Institute of Technology Assessment (ITA) at the Austrian Academy of Sciences. He focuses on the steering mechanisms of information technologies (e-governance) and their impacts on political processes, identity construction, surveillance and privacy protection. Further research interests include information- and computer ethics and the philosophy of information. He has been involved in different European research projects e.g. on privacy, security and surveillance, e-democracy and identity; currently in the project SurPRISE (surveillance, privacy and security)

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Drones for development? The shift from observation to surveillance in the international development field

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Abstract: This paper focuses on the ethical questions raised by the increasing use of big data by aid donors and development organisations to monitor populations in developing countries. A growing rhetoric amongst development organisations speaks of establishing an 'observatory on the developing world' using various forms of emitted and observed data (mobile phone records, geolocation data, microfinance and health records, and social media). This new data is seen as an important way to supplement or replace traditional sources of data for countries where national statistics have been poor or absent. It is also, however, allowing international organisations including the UN to use data science in ways which span the continuum between 'care and control' (Lyon 2009). These new data are much like a drone, hovering high to provide an eagle's view of the lay of the land, and with a potential that ranges from just observing to intervening on the ground, depending on how the drone is equipped. The kind of 360-degree monitoring systems currently being developed would be termed surveillance in high-income countries, but are being justified as a necessary tool to predict economic shocks and food crises, and to evaluate aid interventions in low- and middle-income countries (LMICs). These 'observation' systems raise ethical questions regarding how privacy and data protection should be addressed in new contexts: first, in low-income countries people may not know what information they are emitting and have limited capacity to resist surveillance. Second, privacy may need to be conceptualised for the group (ethnic, religious, political) rather than for the individual as it is currently conceived. Third, this type of observation points out how 'personal constitutive information' (Floridi 2013) is becoming more central to privacy than 'Personal Identifiable Information'. We argue that these new data sources, carrying the benevolent brand of 'development', will almost inevitably experience function creep from observation to surveillance, and that low-income countries may be becoming a laboratory for data science and surveillance.

Keywords: surveillance; big data; development; privacy; information ethics

This extended abstract is available from http://emcsr.net/book-of-abstracts/

The context is the current ‘datafication’ (Mayer-Schönberger & Cukier 2011) of the way international authorities are visualising low- and middle-income countries (LMICs). New sources of data are emerging for people in LMICs: biometrics, mobile phone data, financial transactions, online activities, digital health records. These data are being used to track migration, behaviour, demographic and economic trends. They are different from traditional survey data because data subjects are generally not aware their data is being collected or used. (cf. distinction between ‘volunteered, observed, and emitted data’ (Hildebrandt 2013)). Instead of survey data, which states generate and control, born-digital data emitted by citizens are being gathered primarily through the private sector. Biometrics, mobile-based banking and health systems, and apps are collecting massive amounts of data in countries which have not yet developed adequate data protection laws, and in the absence of a fully-formed civil society to push back against invasions of privacy.

There is a privacy problem. The new ‘observatory on poverty’ (UNGP 2012) includes many sources of data (e.g. financial transactions, geolocation and health records) which would be considered private in high-income countries, and which, if used to track populations and their activities, would be considered ‘surveillance’ rather than ‘observation’. This ‘big data’ is predominantly collected by the private sector and often bypasses national governments. In LMIC’s, national governments are unlikely to have the computing power or statistical knowhow to analyse the data even if they have access to it. This combination of technical demands and a strong private-sector bias gives high-income countries (HICs) a technological advantage in terms of understanding and using the data, and makes either paternalism or attempts at control and management possible outcomes. This data science conducted under the rubric of Development underlines how personal ‘constitutive’ information (Floridi 2013) is becoming more central to privacy than ‘Personal Identifiable Information’. Data may be anonymised, decontextualised and formally authorised by users, but the future uses of the datasets created by development actors are unknown, and once data is available (and in this case unregulated), it tends to be used, reused, shared, merged and linked in ways which may endanger data subjects in LMICs in unpredictable ways, over an indefinite period.

In HICs, much of this monitoring would be considered surveillance. In its broadest sense Lyon (2007) defines surveillance as “(…) the focused, systematic and routine attention to personal details for purposes of influence, management, protection or direction”. This entails that surveillance, in the end is always aimed at ‘social sorting’, i.e. the classification of populations as precursor for differential treatment (Lyon 2004). Even though surveillance as a concept has a bad reputation this differential treatment is always placed somewhere on the continuum between care and control. Organising aid needs surveillance just as much as structural discrimination or persecution does. In the age of big data, datafication is the next step in surveillance, drastically intensifying what Scott (1998) has described as the process of increasing the legibility of developing-country citizens to the state. The process we explore in this paper – datafication on an international level – makes the citizen more legible to her own state, to foreign and international institutions, and also on a commercial level as a consumer. Thus surveillance and observation can be said to be converging in developing countries, potentially to the benefit of states, international authorities and multinational companies. Where data science is described in terms of ‘development’, ‘aid’ and ‘crisis prevention’, it tends not to be subject to the same scrutiny as it would be in high-income countries. When Murakami Wood (2013) describes the current evolution of surveillance as the emergence of ‘distributed government by technical experts, within transnational networks of expertise’ – he could be describing the standard governance of international development practice by donors in LMICs. The current post-Snowden debate in HICs about how to use big data for democratically agreed purposes of observation where necessary, without subjecting citizens to what they may see as surveillance, highlights the need for democratic checks and balances and active citizen engagement as the cost of surveillance and data acquisition can no longer function as a useful buffer between state surveillance and privacy (Faris and Gasser 2013). A similar debate is both important to promote in LMICs, but also almost impossible to achieve in the absence of interested civil society organisations, high technological literacy, or government concern over data protection issues.

The politics of development turn this type of observation into surveillance. By definition, countries involved in International Development (as distinct from crisis response in cases of famine or natural disasters) are seeking influence over their beneficiaries. This suggests that none of what is being sold under the name of observation is actually observation in the proper sense of the word. As soon as it is more than just careful watching or listening – i.e. it is connected to a (political) agenda – it becomes surveillance. Within surveillance there are still many points on the continuum between care and control, but it is surveillance. Already in 2004, Richard Thomas, the UK's Information Commissioner warned that his country was 'sleepwalking into a surveillance society' (quoted in Brown and Korff 2009), which may be the direction the 6 billion are taking as the big data that is collected is put to work. As soon as data collection and analysis becomes surveillance, many of the 'normal' considerations and worries as voiced in surveillance studies apply: surveillance creep; decontextualisation and recontextualisation; preventive policies based on data mining; blurring boundaries between public and private data and responsibilities, and blurring boundaries between care and control (see for example Lyon 2007; Prins et al. 2011).

Surveillance in the context of International Development highlights some key issues to do with privacy and defining the boundaries of ethical data use. Like surveillance, International Development has evolved from addressing citizens as the objects of state power to addressing them as both consumers and potential adversaries. Identification is blending with commercialisation and securitisation. Thus the internationally funded census or health survey is becoming replaced with international access to mobile phone geolocation details, financial transaction data and biometric IDs which are linked to every administrative and commercial interaction in a citizen's life. Just as the practice of state surveillance has moved from visualising bodies to data, so has development moved from engaging with individuals through agricultural extension, direct health interventions and education to 'datafying' the activities and movements of its subjects, and observing at arm's length with the aim of stepping in if things go off the desired track. This could develop into a Foucauldian (1977) mould of power relations in which subjects 'internalise the gaze' of the observers and self-correct their behaviour, i.e. they start to police themselves (Murakami Wood 2013). Thus despite the push since the 1990s for developing countries to be included in development policy planning (as seen in the Paris and Accra agendas on aid harmonisation), datafication will make it easier for donors to invisibly bypass states with their development policy.

The issues highlighted by this use of new data are both in the area of privacy, where datafication in LMICs presents new challenges, and in the area of the governance of international development. In the sphere of privacy, tracking and monitoring poor and/or vulnerable populations raises the need for new forms of consent from technology users who are not yet fully technology-literate; it also raises the challenge of protecting groups rather than individuals from profiling and public identification. In terms of governance, the new sources of data are likely to exacerbate existing power asymmetries, since donor states and international institutions can bypass developing-country governments not only in the process of data gathering, but also through the increased involvement of the private sector in data gathering, data processing and sponsoring interventions under the rubric of Corporate Social Responsibility. If data is generated through the private sector, e.g. a mobile phone company, then shared with international development organisations which then conduct analysis and act upon the findings, the state in which the intervention takes place may not be involved at all.

This trend is important for two reasons. First, a more diverse set of players with a more diverse set of aims. The donors interested in influencing LMICs socially and economically are no longer the HICs of the West, but include the BRICs, Iran, South Korea and many other countries, plus international bodies including UN Global Pulse, the World Economic Forum, the World Food Program, and the International Organisation for Migration. If international development can be described as politics and commerce by other means, it is increasingly possible to pursue those aims directly within communities, regions and consumer blocs rather than through a negotiated collaboration with the state. Second, little stands in the way of maximising data collection and increasing the power of outside bodies to intervene in LMICs. Developing countries often lack the resources to resist infractions of privacy: data protection laws are often nonexistent or unenforced, and governments' technological capacity (and thus awareness of such monitoring) may be low. Finally, the claim of benevolent motives attached to 'International Development' is being extended to data science and being performed at arm's length, making it harder for states to respond to and regulate.

Our argument is that data science conducted about LMICs under the benevolent brand of 'development', is experiencing function creep from observation to surveillance. Data maximisation is occurring; actors are unregulated (private sector firms acting outside their countries of origin); donors are motivated to provide an unprecedented level of detail on the subjects of development due to pressure to show results and justify development budgets; and there is a strong and growing record of humanitarian benefits stemming from data science in crisis conditions which is being used to justify the expansion of monitoring under all circumstances as a preemptive measure to protect the poor and vulnerable. Under these conditions surveillance is unlikely to diminish or the actors involved to subject themselves to voluntary controls. In fact, it is likely to rapidly look more like surveillance and less like 'development', while still using the argument that development is intrinsically benevolent.

If LMICs are becoming the testing grounds of data science, there is a case to be made for closely monitoring the boundary between care and control in this context; for determining responsible bodies to regulate and monitor the data science being conducted on LMIC subjects; and particularly for reevaluating the nature and priorities of privacy in an LMIC context, where potential problems may differ radically from those of HICs.

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II A 3
Urban systems research

Chairs

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In the midst of a (perceived? constructed?) crisis of civilization there is, on the one hand, the lure of large scale urban models up again. Rabino suggests their comeback to be desirable and achievable [1]. A key to large scale models is 'big data' that now becomes available in real time through large sensor networks, and processable through more powerful computing [2]. Such data and models might help to reveal "remarkably universal, quantifiable features" [3] of average cities – but (how) will it help to take decisions to develop a particular urban systems? Bearing this question and the inherent complexity of urban systems in mind, it seems appropriate to review and reconcile the variety of urban models scattered across the disciplines [4]. Thus, on the other hand, a more refined complex systems understanding of cities could evolve from different approaches to modeling that are complementary in their ways of conceptualizing and illuminating very diverse aspects of urban reality [5]. In order to follow this path, some questions are due, e.g.: In how far are the modeling approaches available across disciplines useful for understanding and dealing with complex (urban) systems, where cultural, economic, political and technological systems are nested within each other and eventually within the earth's ecosystem? How can these modeling approaches be verified and validated [1]? Which are the particular limitations and deficiencies in our modeling approaches when it comes to complex urban systems? How can these limitations be overcome? Does a threat to people living fulfilled lives come from the application of modeling approaches unfit to modeling complex urban systems but nevertheless informing policy makers and urban planners? Could a 'melting-pot' of modeling approaches from various disciplines be created, eventually also bridging the gap between quantitative and qualitative, descriptive, approaches and different cultures of science [1,6]? And which (new, complementary) approaches are required for modeling cities?

List of Contributors

Ernst Gebetsroither-Geringer: Interactive participatory urban modeling and simulation
Jens Gurr: Quantitative, visual and verbal models of urban complexity: achievements, limitations and complementarities
Ivan Herrmann, Niamh O'Connell, Alfred Heller, Henrik Madsen: Cities: centre for IT-intelligent energy systems in cities
Pavel Holubec: Conceptualising the urban system as a system of flows

Najd Ouhajjou, Wolfgang Loibl, Ernst Gebetsroither-Geringer, Stefan Fenz, A Min Tjoa: Semantic modeling of urban energy systems: an incremental approach

Rashidah Ab. Rahman: 4D urban informatique goes public

Matthias Scheutz: Can big data help the architect? Directions for agent-based modeling in urban design and planning

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Interactive participatory urban modeling and simulation

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Abstract: The approach of interactive participatory urban modeling and simulation was developed as a part of the Urban Development Simulator (UDS) within the FP7 EU project called urbanAPI (2011-2014). The approach is used for the city of Ruse in remote northern Bulgaria at the Romanian border as a support for the local urban planners and politicians to evaluate high level planning decisions. The UDS is developed as a generic simulation framework, the concept can be applied to other cities too, to generate tailor-made urban planning support tools, if the necessary geospatial data about future planning scenarios and related statistical data describing the socio-economic state and future expectations are available. A complex user interface for urban planners and a web interface to interact with the local citizens have been developed. Thus the preferences of the local residents can be involved into the planning decisions by their voting for selected planning decisions or locations within the city. The spatial pattern of the preferences serves as an input for the parameterization of the Agent-based model to simulate the development trends within the city, if the urban planners would follow the citizens' preferences. This enables the decision makers to adapt their urban development plans by considering the preferences of the citizens. The model runs as a Java web-start application and is hosted on a server in Vienna at the AIT with remote access for the Ruse users. For the model development the modelling platform MASGISmo (Multimethod Agent-based (ABM) System dynamics (SD), GIS modelling platform) has been used. The extended abstract will concentrate on the interactive participatory approach and not consider technical details of the UDS or other features. It will briefly be shown how the preference patterns of the local residents can be used to come up with more appropriate urban development strategies.

Keywords: Urban planning; Participatory simulation; Agent-based Modeling; Multimethod modeling

Acknowledgement: I would like to thank the City of Ruse and the European Commission for funding the project.

1 Introduction

Urban areas are aimed to be innovation ecosystems[1] wherein important solutions are created or deployed to accelerate the necessary transition to a more sustainable, resource efficient urban system. More often citizens act as a proactive catalyzer of innovation, shaping cities, shaping as actors of change. Decision support environments as the Urban Development Simulator aim to facilitate the integrated urban planning, bringing the citizens view closer to the local government and their development plans for the city.

Developments within Cities are often based on an interaction between top-down planning decisions and bottom-up processes. This interaction allows stable structures to develop, with a complex organization and a connectivity-rich network (Salat & Bourdic 2012, p. 60). Owing to the high complexity present on and between various spatial and hierarchical levels, computer models have proven useful in the analysis of different urban developmental paths. Complexity in this context means a (non-linear) feedback structure connecting the elements within one and on different levels of the system. Many different urban planning tools exist whereas all of them are not very appropriate to integrate to the above mentioned different local actors. Tools like UrbanSim (Waddell, 2002), EnerGIS (Girardin, 2010) or SynCity (Keirstead et al., 2010) and others (Connolly et al., 2010) have their fields of application. The main challenges of many of them are to get the necessary data for parameterization and to create a user interface thus urban planners are able to use the tools. Timeseries from the past most often are analyzed to forecast the future trends, however for many cities the needed data for this is either not available or not in the right format and resolution. The use of the local residents can help to close this data gap by analyzing their preferences, which will influence the development of the city.

2 Urban development simulator

2.1 A complex simulation environment combining different methods and tools

The core module (UDS core in the figure below) of the Urban Development Simulator (UDS) is embedded within a complex environment combining different tools. The figure below shows that the environment is located at a server at AIT, at least at the moment, but this could be changed e.g. to directly deploy it on a server within the city using the UDS (in our case Ruse-Bulgaria). The core UDS module programmed in Java runs with Java web-start and thus platform independent. To generate the UDS, a model development platform called MASGISmo[2] (developed at the AIT) was used and enhanced to enable integrating the main features, which have been requested by the local urban planners. To integrate all the needed features, several open source tools have been used, as a Geoserver[3], and an online

1 Innovation ecosystems are characterized by a combination of top down and bottom up initiatives, leading to networking and collaboration among stakeholders, which eventually extend to real innovation communities..p.6 http://www.openlivinglabs.eu/sites/enoll.org/files/FIREBALL%20White%20Paper%20Final.pdf

2 Further details on building models using MASGISmo are detailed elsewhere (Gebetsroither 2007 or Gebetsroither 2009, pp.63)

3 http://geoserver.org/display/GEOS/Welcome

questionnaire software called LimeSurvey[4]. A web portal software called Liferay[5] is used to collect all the information needed for the UDS and to provide a common entry point to all the features. For training and documentation, online tutorials, as training-videos and annotated screenshots, are available. The internet questionnaire using the software LimeSurvey stores the results in a PostgreSQL database, thus with MASGISmo's database connection the information can be used in the simulation (details are given below).

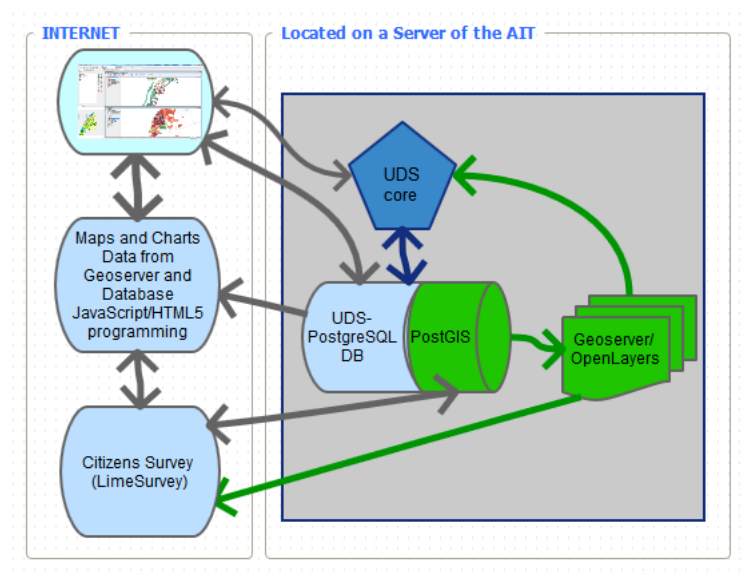

Figure 1: Complex simulation environment (© Gebetsroither, 2014) green arrows indicate data flows from or to the GeoServer; gray arrows indicate data flows from or to the database; blue arrow indicate the direct communiction between the core UDS and the database;

2.2 Citizens participation via Internet questionnaire

One main requirement for the urban planners of the city of Ruse was to get a better knowledge of the preferences of their citizens. Within the project, a new approach was developed integrating an online questionnaire, e.g. asking the citizens in which areas they would like to move within their city, into an interactive simulation tool, which can be used by urban planners. The figure below shows on the left side a screenshot of the online questionnaire, in which each citizen can vote for areas (500m raster cells) they like most or never would want to live in. The right side of the figure shows how the votes in the UDS are depicted as maps, whereas red colors show the so called no-go areas and the green cells indicate the most liked areas. This kind of attractiveness maps for the city can be used within a scenario simulation as target or repelling areas. For examples questions as what would be the impact on the land use or local energy demand, if the assumed population development (increase) could evolve along the preferred areas. Furthermore, the citizen's attractiveness maps, combined with the current development plan ("master plan") for the city, deliver important input for the local urban planners to evaluate (adapt) their development plans. The user of the UDS can simulate different scenarios, combining new development plans (zoning maps), which can be uploaded to the database, with different strengths following the preferences of the residents.

4 http://www.limesurvey.com/

5 Liferay Portal is a web platform with features commonly required for the development of websites and portals. http://en.wikipedia.org/wiki/Liferay

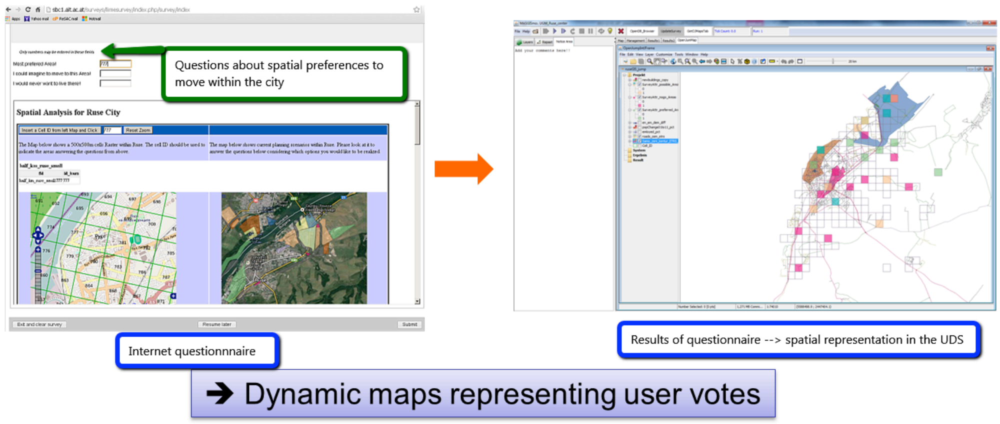

Figure 2: Schematic model of the citizens participation (© Gebetsroither, 2014)

3 Conclusions

The UDS is developed during an FP7 project called urbanAPI, within the years 2011-2014. It will be finished this summer 2014. The first evaluation cycle with the local urban planners has shown that the tool can support their work. It is based on the former work of developing a modelling platform called MASGISmo, which was enhanced and adapted to the local requirements for the city of Ruse. The citizen participation was one of the most demanded features, whereas the UDS has many more features which can support the urban planners. Due to the high complexity of the UDS was it quite difficult to engage with the tool and further training is one of the most often mentioned outcomes of the first evaluation cycle. The results of the participatory process can be used as a feedback to the citizen. On the one hand side, it gives them an impression how the collective view of their city is and on the other hand side, it can serve as an important communication channel from the urban planner and the local government to the people living in the city.

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Quantitative, visual and verbal models of urban complexity: achievements, limitations and complementarities

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Abstract: The presentation outlines mathematical, visual and verbal models as the three arguably central forms of modeling urban complexity and also considers interactions and intersections as well as processes of transfer between them. In doing so, it will argue that mathematical, visual and narrative forms of modeling are each suitable for capturing *different* facets of urban complexity and that they need to be made compatible and must complement each other in their achievements and limitations to facilitate a suitable understanding of urban complexity. To illustrate these points, the presentation will draw on preliminary findings from a collaborative research project at the Joint Center "Urban Systems" at the University of Duisburg-Essen.

Keywords: urban complexity research, mathematical models, visual models, verbal models, limitations and achievements, complementarity, transdisciplinary urban research

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1 Status quo and central challenge

The increasing complexity of urban systems with their social, economic, technological, ecological and cultural subsystems and their multiple interdependencies can no longer be adequately understood in disciplinary terms. Thus, systemic research on urban complexity across disciplines has frequently been called for as a scientific and scholarly endeavor of central importance to contemporary societies (cf. Eckardt 2009, Portugali 2011, Portugali 2012 et al.). Adequate approaches to the modeling of urban complexity in such transdisciplinary fashion, however, are largely lacking.

2 The notion of 'model'

In order to develop an interdisciplinary understanding of urban complexity that integrates in a complementary way insights from various disciplines and approaches with their specific achievements and limitations, the proposed presentation conceptually frames the issue of urban complexity by focussing on the notion of 'modeling' or the 'model', here understood as a material or ideational, frequently abstracted representation of a more complex system or object on the basis of functional or structural analogies, which, depending on the purpose of the model, selectively focuses on different characteristics of the system perceived as central to the specific purpose (on different conceptualizations of 'models', cf. for instance Dirks/Knobloch 2008).

3 Assumptions and research contexts

The presentation discusses different forms and strategies of modeling urban complexity – here mostly mathematical, visual and verbal 'models'[1] – by considering both their disciplinary origins and their limitations as well as their potential contributions to transdisciplinary research. The underlying assumption is that no approach in itself can possibly do justice to the complexity of urban systems. The presentation builds on and extends the author's recent research on multidisciplinary approaches to modeling (cf. Gurr/Walloth 2014 and Gurr 2014a, 2014b (forthcoming) and 2014c (forthcoming), but also draws on preliminary insights from a collaborative project on the modeling of urban complexity across different disciplines and academic 'cultures' (involving experts from the fields of literary and cultural studies, socio-spatial research, social and economic history, logistics and operations research, as well as stochastic optimization and with associated project partners from further fields relevant to urban studies and to modeling, all of them centrally involved in the University of Duisburg-Essen's Joint Center "Urban Systems").

[1] While the notion of mathematical models as the currently dominant form of urban modeling can be taken for granted here, visual models are here understood in the sense of representations in the form of maps and other forms of visualization as, for instance, in social cartography, whereas verbal models are understood in the sense of textual representations such as those found in literary texts.

4 Challenges to transdisciplinary urban modeling

One obstacle to such transdisciplinary cooperation is a very different notion of ‘complexity’ in different disciplines. Thus, while from the point of view of systems theory in the sense of Luhmann, ‘complexity’ might be understood as central to the (self-)description of differentiated modern – frequently urbanized – societies (for a systems-theoretical understanding of urban complexity, cf. for instance Nassehi 2002), this understanding could not possibly do justice to the more technical aspects of urban complexity such as for instance physical infrastructures. Conversely, the understanding of ‘complexity’ underlying most approaches to quantitative modeling cannot adequately capture some of the non-quantifiable features that are no less essential to an understanding of specific urban environments. Thus, while it is possible to incorporate aggregate human behavior, the underlying – individual or collective – patterns of perception, interpretation and sense-making in response to these environments largely escape attempts at quantification.

5 Mathematical, visual and verbal models: Intersections and complementarities

The presentation outlines mathematical, visual and verbal models as the three arguably central forms and also considers interactions and intersections as well as processes of transfer between them. It is important to note here that the boundaries between mathematical, visual and verbal forms of modeling do not coincide with disciplinary boundaries: To give but one example, the visualization of social and demographic data in social cartography is frequently based on preceding quantitative models which, in turn, are frequently informed by (often unquestioned) narratives. The presentation will argue that this makes it necessary not to take for granted the different notions of ‘complexity’ and ‘model’ prevalent in the various disciplines, but rather to question their theoretical and methodological preconceptions and underlying selection criteria.

Briefly considering the normative implications and the mechanisms of selecting characteristics to be included or excluded as well as the achievements and limitations of these different modes of modeling, the presentation also asks to what extent mathematical, visual and verbal models are comparable and compatible. In doing so, it proceeds from the assumption that mathematical, visual and verbal forms of modeling are each suitable for capturing *different* facets of urban complexity. However, it will be argued that these different modes are not *directly* compatible or transferable: Verbal models in literary texts, for instance, since they are primarily concerned with what is individual, specific, or characteristic, already in their selection criteria are virtually diametrically opposed to mathematical models predominantly relying on generalization and abstraction. Nonetheless, and despite the fundamentally different status of the model in different disciplines (models as the result of scientific work in mathematical models vs. models as the object of study as in the scholarly analysis of literary texts), these different approaches need to be made compatible and must complement each other in their achievements and limitations to facilitate a suitable understanding of urban complexity.

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About the Author

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Jens Martin Gurr, born 1974, is Professor of British and Anglophone Literature and Culture at the University of Duisburg-Essen, Germany, and Director of the University's Joint Center "Urban Systems", in which about 70 researchers from all faculties of the University engage in inter- and transdisciplinary urban research.

Gurr studied English and German at the University of Mannheim (M.A. in 1996), received his doctorate from the University of Duisburg for his thesis *Tristram Shandy and the Dialectic of Enlightenment* (Heidelberg: Universitätsverlag Winter, 1999) and completed his post-doctoral thesis at the University of Duisburg-Essen (*The Human Soul as Battleground: Variations on Dualism and the Self in English Literature,* Heidelberg: Winter, 2003). Having worked for a leading international management consulting firm for 2.5 years and after research and teaching positions in British as well as American Studies at the universities of Duisburg-Essen, Bamberg and Waterloo, Canada, he has been Chair of British and Anglophone Literature and Culture at the University of Duisburg-Essen since April 2007.

Two monographs, eight co-edited collections and over 50 essays and articles cover various aspects of urban studies, all periods of British literature, 20th-century American literature and culture and contemporary Anglophone literature and culture. More specifically, his research interests in the field of urban studies include literary representations of urban complexity, the theory and analysis of qualitative modeling in literary texts, urban literary and cultural studies, urban imaginaries, forms and functions of urban popular culture as well as methods of transdisciplinary urban research.

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CITIES: Centre for IT-Intelligent Energy Systems in Cities

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Abstract: This extended abstract provides an introduction to an interdisciplinary strategic research project, CITIES which has been funded with an excess of €7 million from a wide range of industrial and academic partners, and the Danish Council for Strategic Research. CITIES was launched January 1, 2014 and aims at developing methodologies and ICT solutions for the analysis, operation, planning and development of fully integrated urban energy systems. A holistic research approach will be developed, to provide solutions at all levels between the appliance and the overall system, and at all-time scales between operations and planning. This extended abstract outlines the challenges to be met by city and energy planning bodies in an energy efficient future. The necessity of novel, data driven and IT intelligent solutions is stressed. A focus is placed on energy system planning in systems with high penetrations of renewable energy, or those entirely independent of fossil fuels.

Keywords: Urban planning, Energy Systems, IT systems, Modeling; Data collection; Data Analysis; Data Modeling; Interdisciplinary; Optimization; Communication; Forecasting; Biofuels; Power; Electricity; District Heating; Wind power; Renewables; Integration; Gas; Energy; Thermal; Fuel

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1 CITIES introduction

Current energy and city planning methods focus on individual aspects of the city energy system (such as building simulation models), or individual energy flows (such as the power system). In doing so, interaction between different systems is precluded and the efficiency gains that could be achieved by such interactions are sacrificed. The CITIES project (Centre for IT-Intelligence Energy Systems in Cities) aims to provide a platform for cross-disciplinary research to facilitate the development of tools and models for an integrated city energy system. CITIES has received funding in excess of €7 million from a wide range of industrial partners, universities, and the Danish Council for Strategic Research. CITIES was launched on January 1, 2014 and is based at the Technical University of Denmark (located in Copenhagen) in close cooperation with Aalborg University.

2 CITIES state-of-the-art

Urban System Energy modelling are presently (for the majority all research activities) considered as separate systems, i.e. gird, wind, storage, building optimization etc. All are considered as single systems which are optimized without much interaction and communication between the models that form the basis for the optimization. A number of research efforts are currently on-going within the fields of renewable integration and energy efficiency. Many projects focus solely on the power system, and flexibility therein; iPower [1], Ensymora [2], EcogridEU [3], Flexpower [4], SOSPO [5], Development of a Secure, Economic and Environmentally-friendly Modern Power System [6], TWENTIES [7], and PowerHub [8] all investigate aspects of the power system related to the integration of renewables. The 5s project [9] – Future Electricity Markets project will investigate new market mechanisms for systems with substantial penetration of renewable energy sources and new patterns in electricity consumption. Beyond the power system, the Zero Emissions Buildings research centre [10] aims to eliminate greenhouse gas emissions caused by buildings; the EDISON project [11] investigated the potential for EVs to reduce CO_2 emissions within the transport sector and the 4DH project [12] researches 4th generation district heating systems to support the use of renewable energy sources. Individually these projects provide valuable insight into the potential for support of renewables within their sector, but they overlook the efficiency, cost and emissions savings that can be gained by considering the energy system as a whole. The EERA Smart Cities Joint Program [13] and TRANSFORM [14] take a broader view of sustainability and intelligent use of energy within cities. Furthermore, there are on-going smart city development and demonstration projects in ProjectZero [15], Vinge [16] and Nordhavn [17]. The data and experience gained through these and future ad-hoc demonstration will be a valuable contribution to the more structured and holistic approach of CITIES, which can then contribute with insight into the optimal use of the available resources and advise the development strategy to ensure the success of these projects as viable, sustainable, urban environments.

3 CITIES central hypothesis

The current situation within Urban System Energy modelling does not allow for an optimization across all the different Energy Systems applied in Urban areas. We take the standpoint that this is a problem since without a "cross-Energy System" optimization approach then we miss out on all the cross-Energy Systems optimization potentials. The central hypothesis of CITIES is that by intelligently integrating currently distinct energy flows (heat, cooling, power, gas and biomass) in urban environments we can enable very large shares of renewable energy sources, and consequently obtain substantial reductions in CO_2 emissions. Intelligent integration will enable lossless 'virtual' storage on a number of different timescales. Examples of integration are: increasing the flexibility of energy demand by using thermal mass in buildings to store thermal energy; increasing energy supply flexibility by allowing user and district heating plants to substitute between different energy forms for the provision of a given energy service; and harnessing the capabilities of the transmission network by storing heat within the district heating network. In this manner we can increase the storage and flexibility capabilities of the energy system to such an extent that large amounts of renewable resources are both possible and attractive.
Intelligence is the key to accessing this potential; communications, control, optimization, forecasting, and big data will facilitate the modelling, operation and planning of an integrated energy system with the required flexibility to ensure that energy supply and consumption are reliably and economically efficiently matched. Crucially, the flexibility allowed by energy system integration is not limited to hourly or daily time scales, but extends to the seasonal scale, for example, seasonal storage of wind energy by intelligent use of the gas/power systems in combination with CHP plants. Figure 1 illustrates the concept of CITIES.

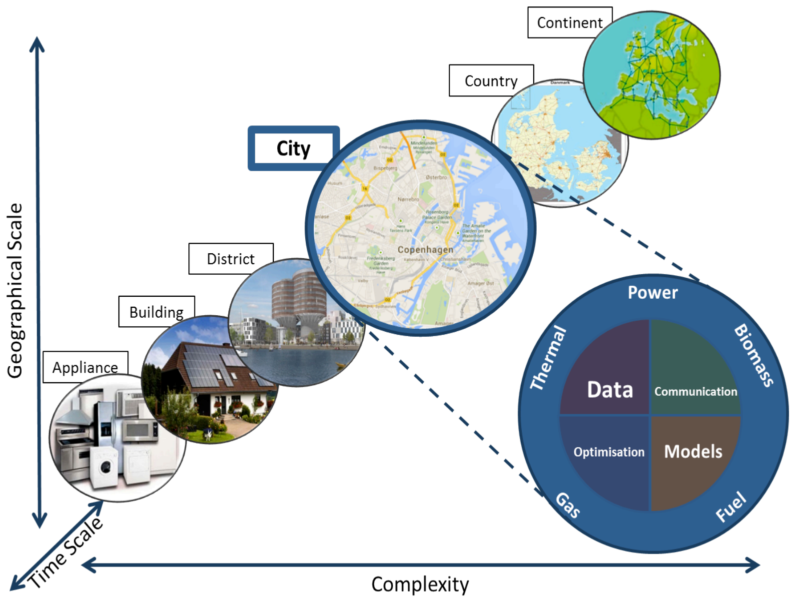

Figure 1. Illustration of the concept of CITIES.

Cities are a prime candidate for energy systems integration, due to high densities of population, energy and communication networks, and the wealth of readily available data (both technical and socio-economic). Data will play a pivotal role within integrated cities, with models bridging the gap between physical and data-based statistical modelling. Novel methods are required to handle, store and distil the vast volumes of data collected in a smart city, to inform and validate such models, and support the continual evolution of adaptive models.

Modelling such an integrated system is a very complicated task; tailored models are required for operations, forecasting, optimization, planning, simulation, and market participation among others. Each of these models must consider the complexities of its system, such as discrete decisions (e.g. where parts of the system can either be functional or not), nonlinear processes (gas and power flows, fuel-to-produced-energy, water-to-produced-energy), uncertainty (energy demand, energy cost, wind power generation, availability of generating units), and interaction of different actors (producers, consumers, market operators, physical and social events). Furthermore, the models must facilitate different scales in time, space and degree of aggregation; from control of a building's power consumption on the seconds scale, to the planning and development of a district heating and cooling network over fifty years. The vast number of operational possibilities (and energy vectors) within an integrated energy system, and the potential to switch rapidly between control frameworks, energy supply form, and countless other variables within an intelligent system necessitate a new approach to system planning that incorporates operational strategies so that the sensitivity of planning outcomes to operational decisions (energy production portfolios, market structures, aggregation of resources) can be fully understood and accounted for. Existing tools such as WILMAR [18], Balmorel [19], and EnergyPLAN [20] currently support the planning process within the energy sector, however, further refinement of their methods is required to ensure their continued relevance, and a new platform to support interaction between these and other models is critical.

4 CITIES methodology

When considering an integrated energy system, it is insufficient to consider only one time scale, or only one level of aggregation (e.g. a development of 100 residential buildings). It is imperative that all scales in time and aggregation are considered, so that the operational complexities are considered within the longer term planning problem, and the technical interactions and characteristics of a small number of system elements (e.g. electric vehicles) are considered in the frame of a system wide aggregation, which could be a directly controlled technical solution, or an economically efficient energy market-place. Such a platform does not exist to the best of our knowledge. The ambition of CITIES exceeds the limitations of existing modelling platforms due to; exponential time demands for simulations of complex systems, lack of interoperability, fundamentally different modelling approaches that do not meet each other's conditions, a lack of common understanding, theoretical frameworks and nomenclature, and much more.

Such an ambitious task requires a highly flexible modelling and simulation platform, optimally in a modular form, where elements can be added or removed as required. Highly detailed models of the individual components of the city energy system are not relevant to the objective here. Instead more granular models are favored, where the central characteristics, dynamics and uncertainties are captured. Data-driven modelling is ideal for this task, and a city energy system activated in a smart grid manner with a wealth of sensors and data collection provides the ideal environment. Component level, modular and aggregate models of energy supply, consumption and transmission resources, suitable for implementation in energy system simulation, control, and optimization frameworks will be developed within CITIES. It will be necessary to analyze system dynamics at different time level and this may bring about the need for "abstract models" that are able to perform real time simulations and long-term simulations. These models will be employed within simulation frameworks to facilitate the development of local control strategies, market frameworks, forecasting portals and system planning strategies, among others.

4 CITIES outlook

50 % of the world population lives today in urban areas. It is projected by the UN that in 2050 the World population will have increased with 3 billion people. All in Urban areas. This increase in the urban population worldwide calls for new and innovate Urban Energy Solutions. An Urban Energy System optimization across the different Urban Energy System as envisioned in CITIES will enable a) an Urban Energy System which ultimately can run at lower costs, b) a more optimized (or efficient) Urban Energy system will also improve environmental and climate impacts from the Urban Energy system due to e.g. lower Greenhouse Gas emissions.

The official CITIES homepage is currently under development and can be found at: www.smart-cities-centre.org.

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Quantitative sustainability assessment methods; Risk management; Data analysis and its communication for supporting sustainability assessments; Evaluation of uncertainties in decision support; statistics

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Conceptualising the urban system as a system of flows

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Abstract: A conceptual paper that strives to extend systemic thinking into the field of urban and territorial planning. It is focused on explanation of the evolution of urban and territorial structures. Because of utilization of the concepts of systems theory, it could be used also for modeling complex urban systems. In approaching a "flow theory of cities", there is, largely in Luhmannian terms, delineated a self-referential system of flows, whose constitutive difference is whether certain part of space is assigned for movement or not. This system is in place for the sake of sustenance of human bodies and for operation of social systems. It exists because systems that produce the flows exist. The flows emerge because systems are spatially dispersed. And the system of flows differentiate itself due to the differentitation of other systems and also due to its own differentiation. There are distinguished two types of flows: sustaining flows that keeps the matter-processing systems going and communicating flows that keeps the meaning-processing systems operating. Within the flows we differentiate several dimensions: direction, composition, intensity and character. System of flows operates by relating and directing the flows in all their dimensions. With rising population and increasing social and spatial differentiation, there rises also the complexity of the system of flows that the system needs to handle – and strives to reduce it. Such reduction leads to the emergence of channels (main roads) and of centres. Centre points there where the positive feedback processes takes place and in these places occurs also various kinds of accumulations. While positive feedback leads to urban differentiation, there is also negative, regulating feedback, that generally stabilize the flows, homogenize the space and leads to the solidification of channels and centres. Due to this dynamics, we can conceptually distingush centres from cities: while centres emerge out of the operation of the system of flows and especially due to the complexity-reducing operations with positive feedback, cities are results of second order operations and of negative feedback: they are results of observations that are assembled, assessed and reinserted back into the organization of space and of flows in a form of urban plan.

Keywords: Systems theory; Self-referential; Complexity; Differentiation; Flow; City; Urban; Centre; Emergence; System of flows; Flow theory of cities

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Introduction

How to conceive of cities, territories or states while avoiding fixites, permanences or essences? How to describe structures that are in a permanent process of becoming: building, maintenance, renewal, decomposition? How to grasp the complex relations between social systems, various organisms and their spatial-material environment? All these questions can be summed in one: how to adequately grasp the processes that are shaping our increasingly urbanized planet in order to eventually alter them? My answer is sketching that what can be provisionally called a *flow theory of cities* whose central concept is a *system of flows* that is modeled on Luhmann's notion of self-referential systems. This system is in place for the sake of sustenance of human bodies and for operation of social systems. It exists because systems that produce the flows exist. The flows emerge because systems are spatially dispersed. And the system of flows differentiate itself due to the differentiation of other systems and also due to its own differentiation.

While the paper is mainly conceptual (theoretical), focused on understanding to the processes that shape the environment, where we live (in permanent settlements), and on explanation of the evolution of urban and territorial structures (how did cities emerge?), because of utilization of the concepts of systems theory, it could be used also for modeling complex urban systems.

According to Luhmann (1995), for a system to rise there must be a closure distinguishing the system from its environment. *System of flows* most probably rised when humans started to form permanent settlements. There came the need to assign different functions to various parts of usable space, which was then, generally, Earth's surface. The distinction between system and its environment lies in assigning one part of space to all those elements that move – for *flows* – in order to develop something permanent in other parts of the space. And it turns out that for establishment of permanent settlement the most permanent use of space is the part that is used for movement. The difference that constitutes the system of flows in spatial terms is therefore whether certain part of space is assigned for movement or not.

Where psychic and social systems employ *meaning*, system of flows in its place employs *flows* themselves. We can distinguish two different but enmeshed types of flows: *sustaining flows* and *communicating flows*. While sustaining flows keeps the matter-processing systems going (organisms, machines) and are generally unidirectional, communicating flows keeps the meaning-processing systems operating (psychic and social systems) and are generally circular, two-way.

System of flows operates by *relating and directing* the flows in all their dimensions. We can distinguish these dimensions: in a dimension of *direction*, flow can be diverted or re-routed; in a dimension of *composition*, flow can be aggregated or decomposed; in a dimension of *intensity*, flow can be splitted or merged; in a dimension of *character*, flow can be translated or transformed. The *relations within a system* are relations between the flows: they may share an origin (*source*) or destination *(attraction point)* or they are result of system's operation. But there are also *relations to the environment* – every flow is related to some other system where it originates, ends or within which it operates. So in flow system's environment there are various social systems, food webs, production systems etc. All these are complex systems that connects one to another, interpenetrate and differentiate themselves – which further increases the complexity of the environment.

Now we can realize that it is quite complex system of flows where relations among flows are multiple, overlapping and connecting multiple origins and destinations. From a system's perspective, there arise the necessity of reducing system's complexity by contingent selections, accompanied by increase in system's definitude.

One principle of reducing this complexity is by the aggregation of flows. In the same way that rainwater, due to the terrain characteristics, sooner or later creates watercourse, the multiplicity of flows in usable space leads to the selection of paths, roads and streets. And every contingently selected path may affect the subsequent selections (and we can see that in urban history). Aggregated flows are more intensive and that leads to their further differentiation as well as to the creation of stabilized channels (main roads). Other way of reducing systems complexity is by division of various kinds of flows into specific channels. So there are, for example, lanes in a street with different speed (foot paths for pedestrians, cycle lanes for bikes, traffic lanes for cars, dedicated lanes for public transport).

Complexity is reduced also by handling various constraints in system's environment, most notably by the time constraint and energy constraint. For example, time-delay affects character of communication, and the flow of food is inherently time-limited by food's durability. These constraints forces the flows to become shorter and we can generalize by saying that constraints often induce *territorialization* of the system of flows. On the other hand, constraints also put a pressure on system to evolve and differentiate itself.

With territorialization and differentiation, we get to the emergence of cities and increasingly differentiated use of space. Following on Taylor (2012) and De Landa (2000), there seems to be co-evolution and mutual dependence of cities, agriculture and trade. While growth of human settlements meant increasing intensity of their sustaining flows, it put pressure on development of either trade or agriculture because otherwise the local resources would have been quickly depleted and settlement abandoned or dispersed. Once the flow of food was secured, settlement could grow and differentiate further – and become a city. When we speak of early cities, among their characteristic features are often listed walls and planned layout – which can both be interpreted in terms of second order dynamics, that is system controlling its constitutive elements: walls as a system-boundary, planned layout as an attempt at reduction of complexity.

Other thing is that while the sustaining flows rises with population growth linearly, communicating flows rises exponentially (total number of potential contacts between residents amounts to the square of population). However, more than indication of actual communication flows within a settlement, this indicates the complexity that the system of flows (as well as social system) needs to handle. Increasing population size of the settlement is therefore, more than other things, a powerful differentiating force that pressures the system to reduce its imminently rising complexity.

Within a settled area, such reduction leads to a selection of preferred routes – and differentiation into main routes and side routes. Such selection is made by a mass of people that make the flows flowing. Minimization of time and energy spend on movement seems to be quite good outer-system selection criteria, especially in rough, hilly or water-dominated terrain. But orientation of people in the system of flows and situating of particular *points of attraction* gains weight especially in inter-system development. The positive feedback (fueled by time-saving strategies) attracts the attraction points together, which intensifies the flows that are going there, which influence the selection of main routes or leads to re-routing. Main routes are generally more attractive and attractivity of their intersections counts as a sum of the attractivity of the routes that intersect there. This is how *centre* emerges. And while observing how the centre emerges, we can conclude that *centre points there where the positive feedback processes takes place*.

But besides positive, *differentiating* feedback, there is also negative, *regulating*, feedback (De Landa 2000). While positive feedback generally increases differences and intensity of flows, negative feedback generally *homogenize*, get rid of extremes, stabilize the flows. The most apparent form of negative feedback in the system of flows is the *solidification* of channels. It is more difficult (needs time, energy, material) to redirect the paved street, to narrow down the daily used street or to tear down the buildings that define the street space. Among the results of positive feedbacks belong not only the emergence of centres but also various kinds of *accumulations* in centres. Centres function as attraction points for a multiplicity of flows – every centre is in fact an *attractor* itself: centres are like seas for water that flows to them and accumulates there. Centres, via control over various reservoirs (of people, food, legal and military power, energy, money etc.), therefore utilize these reservoirs for a system-specific purposes. E.g. for managing the outcome of positive and negative feedback loops for specific goals, one of which is often maintaining the *centre* as centre, which is indeed pure self-referential operation. This process may be called *solidification of centres* which is just *solidification*, as mentioned earlier, on a grander scale.

But the concept of *system of flows* implies that even such solidification of centres usually leads just to the re-direction of flows, because if solidified centre becomes unnecessary obstacle for the flows, the system finds or creates a new routes which may end up in emergence of new centres – even by means like shadow economy, political secession or massive migration of people. The basic postulate is that *if there are flows, the system of flows always finds a way*.

If we understand the notion of centre in an above formulated way, it becomes easy to see why the notions of *centre* and *city* seems to be conflated for great part of human history. My proposition here is that *centres emerge out of the operation of the system of flows* and especially due to the complexity-reducing operations with positive feedback. *Cities*, on the other hand, *are results of second order operations*. They are results of observations (of how do the settlement and various subsystems work) that are assembled, assessed and attempted to reinsert back into the organization of space and directing of flows in a form of *urban plan*. As you know, every urban plan, every masterplan, in one way or the other, *distinguishes stabilized areas and areas of proposed changes*. And here we can see, that this is just another form, where do the constitutive difference of the system of flows re-appears as distinction: where are located the proposed changes? Which flows needs to be redirected? What feedback loops needs to be regulated?

Looking closely at the growth of urban centres, there are multiple ways of reducing their rising complexity. We mentioned aggregation and differentiation of flows that results in emergence of *streets* and specialized *districts* in case of a single urban area, as well as in emergence of territorial systems with multiple *cities*, *towns*, *villages* and various single-purpose areas (farms, mines, forts, ports etc.). Just in listing various sites and subsystems, we can see, how closely is linked differentiation of urban and territorial systems with differentiation of society. Even the differentiation of *urban* from *territorial* systems, of *cities* with intensive use of space, higher population densities and greater number of communicating flows, from *landscapes*, where are located activities with extensive use of space (agriculture, pastures), is a way of reducing the complexity. This is *territorial differentiation*. With emergence of multiple centres of accumulation and with introduction of regulating feedbacks, we can also notice emergence of *territorial states* (Taylor 2012).

Another way of reducing complexity is introduction (emergence) of *scale*: there are *main roads* between the districts within the city, and between towns and villages within the territory, and there are *streets* and side-roads that connects the plots and houses to the main roads. And with emergence of centralized states, there is *capital city* and other cities. What the scale introduce, is nesting of similar structures that results in fractal geometry of space that is easy to remember.

A rather different story is *functional differentiation*. The reduction of the system's complexity results in emergence of subsystems that are focused on specialized task. An example may be the transition from sustainable families or clans, whose members in countryside produces food for those in the city, to the market economy, where the exchange of products of farmers and craftsmen is facilitated on the market via abstract exchange device – money. And here we see that with differentiation into subsystems emerge exchange points and a notion of risk (is the supply of necessary products sufficiently reliable?). So there came also traders with warehouses and shops, and bankers that takes care of the money system, of distribution of flows in time and of risks that are internal to the economic system. And with differentiation and risk came also various redundancies: multiple roads to the same destinations, long-term storehouses, suppliers from various regions, duplicity of various subsystems and their parts.

With reductions of complexity, we need to distinguish *complexity-reducing operations* from *complexity-reducing adjustments*. The first, the operations, utilize the existing system and its capacities, so it can be re-routing, aggregation of flows, splitting and merging, temporary storage – all the possible *operations* of the system of flows, as mentioned above. But the second, the adjustments, *alter the system* in one way or the other, so it is no longer choosing a different road, but *building* of a different road, it is introduction of new exchange points or a creation of entire new subsystems. We can often notice, how *adjustments* originate in repeated *operations*, how certain *practices* are *institutionalized* or *standardized*, and how certain *innovations* proliferate throughout the system. I guess that innovations are emerging somewhere within a system all the time in order to solve the elementary operations of the system of flows – that is relating and directing the flows – but the thing is that not every innovation spread. What do we usually call *emergence*, seems to be linked precisely to the degree of proliferation of certain innovation. Such degree that alter in some way the operations of the whole system, so the system *must* adjust. Because of this, we talk of the emergence of cities not when the first city appeared but when there are multiple cities documented for sure and they develop such momentum that whole landscapes and societies are changed, and the changes reverberate much beyond the system of flows itself.

In conclusion, although this paper is largely theoretical or conceptual, it strives to extend systemic thinking into the field of urban and territorial planning and contribute this way to the understanding ever more complex urban reality of global society and possibly also open new perspectives for approaching the problems and challenges of our time.

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Semantic Modeling of Urban Energy Systems: an Incremental Approach

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Abstract: The need for developing city-level energy strategies is increasing, given the ambitious CO_2 emission reduction targets, such as the European 2020 and 2050 targets. Thus, there is a growing need to adopt systemic approaches in modeling urban energy systems for decision support purposes, to understand the impact of decisions in their global context. This research presents a semantic modeling approach (for urban energy systems modeling) i.e. describing the system by formalizing the vocabulary of its components, properties, and interactions. The semantic model is used then to ensure data consistency and integration of different computation models, in a complex system, by sharing a common vocabulary and understanding of interdependencies (i.e. the semantic data model). The approach is validated through modeling a building-integrated solar PV planning support system. The application of the system takes place in a district of the city of Vienna, of about 1200 buildings. The system is extendible to include other measures, such as building refurbishment or decentralized wind power generation. The main features that distinguish this approach compared to state-of-the-art are: (1) it is an incremental approach that enables gradually moving toward a more global and complex system. (2) This approach enables re-using heterogeneous existing computation models (regardless their different modeling approaches). (3) It considers different perspectives of stakeholders with affected interests, regarding the addressed problem. (4) The resulting system is robust against data availability problem (can be used in different cities), by offering, formal extension mechanisms and the flexibility to integrate different computation models that require different levels-of-detail.

Keywords: urban energy systems; semantic modeling; decision support

1 Introduction

Two-thirds of the overall primary energy consumption in the world occurs in cities [1], resulting in 71 percent of energy related direct greenhouse gases emissions in the world [2]. Thus cities represent a rich ground for taking action to meet the ambitious targets that have been set, such as the European targets in the horizon of 2020 and 2050 [3]. Therefore, it is important to develop integrated strategies that state what quantitative measures (decisions) are to be taken to reach these targets. The success of these strategies also relies on assessing their impact on the whole system, making sure that they have also a positive influence on their global context.

Given the complexity of the urban energy system (UES), energy planners require computational support to assess the impact of their energy strategies (set of measures) and support their decision making process i.e. which measures to take, in which quantities, how they affect different stakeholders interests, and how they affect the UES.

2 Related work

There exist a large variety of models and software tools that cover segments of urban (energy) systems (rather than the system as a whole) and that can be adapted and used within the context of urban energy planning (decision) support, such as UrbanSim [4], EnerGIS [5], Syncity [6], CitySim [7], Suntool [8], CommunityViz (an ArcGIS extension) [9] and others that can be found in [10]. Similarly, there exist several modeling approaches for urban systems mainly based on agent-based modeling (ABM), system dynamics modeling, or combinations of methods such as [11]. These approaches might face scalability problems when modeling large, complex systems where these approaches are not necessarily applicable to all the domains that require modeling, given the scarcity of data at cities level.

A more specific assessment of the existing tools and models in terms of their applicability to the specific needs for urban energy planning support, an analysis of the urban energy planning process has been performed [12]. The goal of the analysis was to extract the characteristics that have to be satisfied by models or tools that support this process. The analysis was based on the sustainable energy action plan (SEAP) process [13], a widely spread process over Europe (more than 5000 signatories by February 2014). The analysis led to four characteristics: **(i)** Support of multiple perspectives of different actors; **(ii)** quantifiable assessment of the impact of decisions and its aggregation to a shared level of understanding among all actors. **(iii)** Integrated assessment of decisions impacts. **(iv)** Usability of the system in different locations (cities), with different data availability and levels-of-detail, recalling that this is a critical issue given the large amount of data that is required to model energy systems at the city level.

The four characteristics that resulted from the analysis of the urban energy planning process are not met all at once by the existing models. Concerning the modeling approaches (e.g. ABM), their purposes are complementary to the semantic modeling approach (as a semantic model does not perform by itself any computation). These approaches are still usable in combination with the proposed solution, as it is explained in the section below (in the computation models check phase).

The proposed solution bridges the gap between the existing tools/models and the specific needs in UES planning support. The semantic model describes all the relevant components

and interactions within the UES, then it is used as a shared vocabulary and understanding of the system to integrate different models that perform the required computations.
In brief, this approach enables scalability in modeling complex systems through modularization and flexibility in terms of computation models integration.

3 The semantic modeling approach

This research, based on previous findings [12], presents a semantic-based approach for modeling UESs. The approach was applied to develop an urban energy planning support system for building-integrated solar PV (with the prospective extension to include more measures). The system was used in a district in the city of Vienna (comprising about 1200 buildings).
As shown in the figure below, the methodology is iterative and the scope is extended, within each iteration to include more functionality (decisions/measures to support). The current building-integrated solar PV system has been developed within one iteration. An extra iteration is required to include for example decentralized wind power generation planning (coupled with solar PV planning).

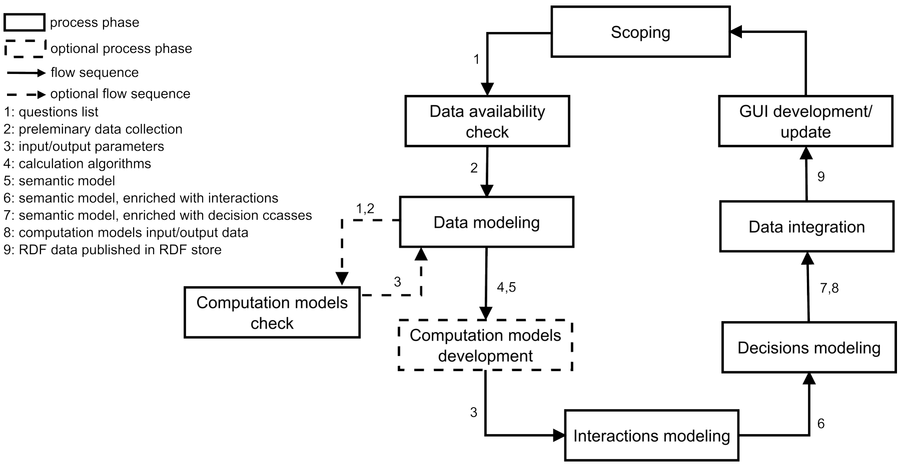

Fig. 1. Modeling methodology overview

Scoping: A measure (decision) is selected (e.g. installing solar PV). Affected stakeholders are defined. Questions that the stakeholders raise to make their decisions are formulated and broken-down to quantifiable questions (e.g. the building owner asks: what is the net present value of the investment?)
Data availability check: an overview about the existing data in the context where the system is to be used is performed. The purpose of this phase is to approximate the level-of-detail that is feasible in terms of modeling.
Data modeling / Computation models check: these two phases are carried in parallel. As stated above, it is possible to integrate existing ready-to-use models/tools (which have been configured beforehand, and already contain data) if they provide answers to the questions modeled in the scoping phase. In that case, the required input and output parameters of these computation models are extracted and classified within the semantic model of the UES. We recall that the semantic model by itself does not perform computations but it rather plays the role of integrating other models that performs this task. In the absence of re-usable computation models, the approach in this research is (together with domain experts) define algorithms that lead to answering the scoping phase questions. Then, the relevant terms in

the algorithms are identified (e.g. gross floor area, roof area, electricity demand, etc) and classified within the semantic model. Detailed methodologies on building semantic models exist, such as [14]. We recall that one answer can be calculated using different computation models that require different level-of-detail e.g. within the same city, answers about buildings that have more detailed data can be calculated with more accurate computation models, while the rest of answers use less accurate computation models. It is always possible to trace back which computation models are used to calculate which answers, as all this information is included in the semantic model, using Protégé [15] as an editor.

Computation models development: this phase is optional and not necessary if existing computation models can be integrated (using the approach described in the previous phase) and that answer all the questions. In this project, Java-programmed computation models have been implemented based on the algorithms that were captured in the data modeling phase. These computation models provide answers about the impact of integrating solar PV systems with buildings from different perspectives: (a) building owner (net present value of investment, investment cost, break-even period); (b) grid operator (transformers overload status and duration, power generation percentage of direct use); (c) city administration (Subsidies cost, saved CO_2 emissions, subsidized electricity generation).

Interactions modeling: links are established between the different parameters within the semantic model. A link is an interaction, which is defined as any parameter (in the modeled UES) affecting another one through a given computation model. Capturing the interactions is required for example when integrating new computation models, to know their impact on the rest of the system. This is also important when changing datasets, to know its implications on other data. The interactions are also described within the semantic model.

Decisions modeling: modeling the interpretation (very good, good, bad) of value ranges of the calculated answers from each single perspective i.e. what is a good building for PV installation from each actor´s perspective: building owner, grid operator, city administration. Then the interpretations are aggregated to a single interpretation that reflects the common interest of all actors (i.e. what is a good building for PV installation from all the perspectives).

Data integration: in this phase, data from various sources that are used by the different computation models are integrated using the semantic model that is developed in the previous phases (describing the components of the system, their properties, used computation models, data interactions, and decisions). An existing tool (Karma) [16] is used for that purpose. Then the data are published (exported) in a web query-able format.

GUI development: The GUI is used for presenting the exported data to the user. It is based on the principle that all the necessary information is calculated beforehand and there is no invocation of the computation models during the use of system. This part has not been implemented yet. The presentation of the data will use a web-based application, using google maps, with a light JavaScript interface.

4 Conclusion and results

This approach was applied to develop an urban energy planning support system, which includes so far building-integrated solar PV planning, and was used in a district of the city of Vienna. The resulting system addresses the four characteristics for urban energy planning support systems. (i) It considers multiple perspectives (building owner, city administration, grid operator). (ii) The different perspectives have quantifiable results, aggregated from single-perspective to multiple-perspective interpretation. (iii) The interactions modeling phase enables re-using and integrating different computation models that calculate answers of different natures (e.g. net present value of investment and transformers overload status) (iv) The system can be used in different contexts since it offers formalized extension mechanisms. The results of the application of the system are available within a locally hosted web server and manually query-able. A preview of results can be shown during the presentation. Developing an interface for the presentation of data is under progress together with extending the system to include building refurbishment.

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4D urban informatique goes public

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Keywords: Urban; Informatics; Public; Datascape; 4D

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This paper addresses the theme 'Emergence and Design – Urban Systems Research'. A review of the literature on urban systems, such as 'Computer, Environment and Urban Systems', 'Building and Environment' or 'Applied Geography', indicates a wide area of development. This comprises modeling studies on the city evolution that cover aspects of urban geometries, typologies of urban built forms, land-use mix and area expansion, including from the historical perspective. Related to this is the evolution of the ecological footprint of the city, changes in landscape, green area and urban forest. On the environmental part, there are various system models on urban water quality, energy consumption, CO2 emission and air quality. Urban systems modeling on infrastructural aspects are also dominant. There are analysis of the dynamics of urban traffic, modeling the urban streets for purposes of fire-fighting preparedness and emergency evacuation besides for retrofitting the urban drainage system and facilitating ICT infrastructure requirements. On the urban economics aspects system dynamics model has been combined with other methods such as GIS and 3D visualisation for assessing residential development or used for studying disaggregated and aggregated urban regions. Methods for estimating the spatial interaction in relation to the labour market and urban navigation and pedestrian movement have also been developed besides dynamic models for generating crime data. In spite of these robust research activities, leading experts in the field of complex systems believe that human policy-making and the ensuing interventions 'make the problems worse rather than better…' This group at CASA University College London views that the limitation is due to such systems being designed at a local instead of the global level. Compounding to this limitation is that complex human problems affect global changes and yet are treated in isolation. Global systems such as trade, migration, security and development aid form part of this extensive chain.

These precedent research works are done from the perspective of the urban authority or organisations that feed to the urban governance and municipality. What is missing is an investigation on urban systems that deal directly with the public or that may provide immediate benefits to them. This issue is of importance because the public is the key players of a city. The 'public equation' within a city has been reminded since the antiquities. As proclaimed by Nicia to the Athenian soldiers, it is not the walls and ships that define a city. Rather, "You are yourselves the town, wherever you choose to settle…it is men that make the city…" It is the people living in the city that breath life into it. Unfortunately, this people component is often time 'abandoned' or 'detached' from the official consideration of urban systems research. No doubt the existing systems models are useful for the officials, such as the town planners, urban administrator and management to forecast and plan for various aspects about the city. Nevertheless, this also has the tendency of city spaces and functions being created and handed over to the public as end-receivers only --- whereas, the investment on diverse urban functions is the most costly. If urban spaces, related functions and systems are to be thought of as a form of economic product, there is a serious lack of direct client commitment and involvement on this; unlike other branches involving design that have a tradition and have developed techniques in user studies, fieldwork, ergonomics, market-research and prototype tests.

This is ironic considering the real purpose of urban systems and design is to benefit the public. The situation is more troubling because the UN Habitat has also predicted that the world will soon be a planet of cities. The organisation has forewarned that the expansion of urban boundaries will soon exceed the rate of population growth. Among the resulting crisis will be that the major portion of the people will not have access to adequate housing, including due to mismatch of housing supply and the people's affordability. Even currently, nearly 1 billion people around the world eke out a living in urban slums. Whilst there have been published initiatives by UN Habitat to reinvigorate the streets for the urban citizens, this paper shares the opinion that such initiatives are mainly skirting the real issue. What is more relevant for the majority of the urban citizens is the means to access information on job opportunities and basic urban housing based on locational or distance value. A paper by Zhu and Ruth (2013) offers an impetus. The paper describes the regional collaboration between industries or inter-firms for resource efficiency. In this sense, job opportunities and adequate housing within an acceptable commuting distance, are also forms of resources for the urban citizens that require urgent studies on the most efficient deployment. This is part of the supply chain that will determine their livelihood within the city. To the best of this author's knowledge, an urban systems model that will capture such data for immediate access by the job seekers and home-renters based on economic best value returns, relative to the distance between work place and living place, and the time involved, has yet to be developed.

This paper takes lessons from the 'Urban Informatics' by Arup (2011) as a form of the city's software; thus looking at urban systems modeling as a typology of design practice. In their case, the multi-disciplinary practice intents on shaping a better world and a great urban experience. They do this via the interaction between information, place and experience. Their product is a series of activation strategies for the city and about the city. On an extended vein, this paper intends to create an alternative urban systems model that represents a 4D datascape of offerings to the public - the '4D Urban Informatique'. This will contain amongst others the datascape of job offerings by location and salary value; datascape of affordable housing offerings by location and rental/sales value; datascape of schooling opportunities by location and tuition costs and the datascape of health and public facilities. Why 4D? The nature of urbanity is no longer suitable to be viewed only on a map or plan. With urban structures taking the shape of mixed developments, the job opportunity may take the applicant to the 100th floor, or that the housing available could be up there in the 'sky' –- likewise for schooling provision and other public facilities. The best way of viewing such an urban systems model is at the very least in 3D. Nevertheless, since it is expected that the datascape of public 'offerings' will continuously change in real-time, logically the model has to include the fourth dimension of time.

This proposal is a theoretical one and is still in configuration. The discourse at EMCSR 2014 in Vienna might shed a more enlightened path for its resolution.

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Can Big Data help the architect? Directions for agent-based modeling in urban design and planning

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Abstract: Agent-based modeling has been successfully employed for quite some time in the behavioral and social sciences tandard text. In this paper, we explore the utility of agent-based models for urban planning and design. We argue that while *Big Data* and agent-based simulations based on it will be of great utility to urban and regional planners, the extent to which architects can profit from *Big Data* is less clear. While architects typically operate under constraints imposed by building codes and market development that often leave little to no room for applying Big Data, there are cases where agent-based simulations could reveal suboptimal utilization of spaces or wrong expectations about human behavior, which, in turn, could have a significant impact on architectural designs.

Keywords: big data, urban design and planning, agent-based modeling, architects

1 Introduction

Agent-based modeling has been successfully employed for quite some time in the behavioral and social sciences (e.g., Grimm et al., 2006). The key advantage of agent-based modeling (compared to other forms of mathematical modeling such as equations-based models like dynamical systems) is that complex behavior is viewed as an emergent phenomenon resulting from interactions among many individual agents. Hence, rather than requiring interaction principles at the group level, which are often unknown, agent-based modelers can simply specify rules for the behavior of individual agents and then run model simulations in a variety of conditions to explore the dynamics of the interactions and the evolution of the model over time. The resultant complex behaviors can then often be captured in terms of higher-level group variables, and laws governing the changes of those variables over time can be derived from analyses of the simulation results.

While agent-based models often generate a large amount of data themselves, they can immensely profit from available *Big Data* (e.g., data produced by other models, data collected from the modeled domain, or data fused from multiple data sources) in at least two ways: (1) the data can be used for setting parameters in the model and (2) the data can be used for validating model predictions. The first case is particularly important for models with a large number of free parameters (e.g., epidemic models of disease spreading or models of urban development) where it is critical to fix as many parameters as possible to reduce the overall parameter space that needs to be explored via model simulations and to produce realistic, applicable results in the target domain. The second case is important for verifying that a model is able to reproduce a known phenomenon at a sufficient level of detail so that model predictions (i.e., model simulations exploring future development of empirical domains) can be trusted (e.g., how urban areas will grow over the next few decades).

In this paper we are particularly interested in asking the question of where available massive data sources – *Big Data* – in conjunction with agent-based models and simulations can help in the design of urban environments and living spaces, from designs by architects, to designs by urban and regional planners. The importance and urgency of this question is evidenced in several ways such as a recent call for an "Urbanization Sciene" (Solecki et al. 2013) or the various new initiatives and research centers that have been formed specifically to investigate the use of *Big Data* for urban planning and development. For example, in 2012, the *Urban Center for Computation and Data* was formed jointly by the University of Chicago and Argonne National Laboratory in the US with the goal to apply computational and data-driven methods for urban planning and design (see www.urbanCCD.org). Other related centers that were recently created are the *Center for Urban Science and Progress* (see http://cusp.nyu.edu/) and the *Urban Systems Collaborative* (see http://urbansystemscollaborative.org/), or even Microsoft Research's "Urban Computing" group (see http://research.microsoft.com/en-us/projects/urbancomputing/), all with the goals of putting available cloud-based services and *Big Data* to use in urban planning and design.

2 Architects vs Urban and Regional Planners

The general question we seek to explore has many subcomponents and whether *Big Data* is useful for architects, urban and regional designers will dependent on the type of data and the aspect of a design or plan it can impact. Take, for example, data about pedestrian flow over the course of a week on a given city block where a new building is supposed to be developed. Depending on existing and predicted flow and existing building and city codes, the sidewalks on the block may or may not be sufficient for a particular design and purpose (e.g., an office or retail building with a certain number of floors and resultant office and retail space). If they are insufficiently for the predicted flow (including the new building), then either alterations to the sidewalks are needed – they have to to be either widened or additional walking spaces need to be created above or under ground – or designs have to be changed. It is easy to see that there is a complex interaction between the pedestrian flow as given by extraneous factors (e.g., residents in the area, connecting city routes, public services, etc.) and the impact the new building might have on it based on its purpose (e.g., whether it is a residential building that just adds a fixed number of local residents and a few guests or whether it is a shopping mall that can lead to a significant increase in pedestrian traffic, potentially attracting many non-local residents). Agent-based models of expected pedestrian flows (where "agents" are used to model the behavior of individual humans) can be of great use in helping the urban designer better understand the constraints imposed by different building purposes and the trade-offs of various options for creating additional pedestrian walking space needed for the new building to be able to confirm to building and city codes (e.g., an analysis comparing the costs of creating additional walking space with the revenue benefits of a shopping center based on the expected utilization). It is even possible to use the simulations to explore possible changes to building codes, e.g., by studying the limit cases of overcrowding in emergency situation and determining that people will still be able to leave the area without mass casualties (e.g., ayanna). *Big Data* can be used here to find realistic parameters for agent-based models based on demographic data (e.g., how many residents live in the area, where they work and how they commute, where the walk locally, etc.). Other examples of possible applications for *Big Data* and agent-based models, in particular for regional planners, are simulations for expected air traffic in an effort to determine the best placements of future airports subject to various urban constraints (e.g., noise levels, protected green belts, highways, urban growth, etc.). Available data can be used to build realistic agent-based models of urban growth where many of the model parameters can be fixed based on the data (agents here might be not have to be individuals, but could represent whole subcommunities).

The above is only a brief hint at the utility of agent-based models for urban and regional planners. But what about the architect? What information about a city, a city block, or even a single building is critical for an architect for making appropriate design decisions? And what information could Big Data provide that could be a game changer in designing individual buildings or complexes? For example, would it help architects to learn about air quality distributions throughout a city, to learn about the urban functions of different regions in the city, to get a good sense of energy distribution, or to learn about traffic patterns and hold-ups? This and other types of available information can be gleaned from available data sources by data-mining and combining the mined data in clever ways (e.g., MS Urban Computing).

Prima facie it seems that *Big Data* might not be of much help to architects because even if agent-based models (or any computational models, for that matter) could be used to determine future trends and fads, the architect would still be bound by current building codes and laws to a point where none of the necessary adjustments to the design based on any of these trends would be legally acceptable. In other words, it seems that the scale at which the architect operates is *too small* compared to that of urban and regional planners for *Big Data* to have an influence.

However, looking closer at the design process and the various constraints, we believe there might still be ways for *Big Data* to have an impact, even at the level of the architectural design of a building. For one, even if *Big Data* cannot change the set of potential designs an architect has to work with for a given building, it might be able to shift the architect's preferences for one over another design. For example, agent-based simulations of the movement patterns of humans during the day in an office building might reveal very different pedestrian flow for different occupants (e.g., a legal firm versus a marketing firm versus an insurance agency). Based on the different flow patterns (which could be generated by agent rules that are developed and parameterized with fused data mined from available data sources, possibly including data obtained from tracking humans in such buildings over time via vision algorithms running on images from security cameras already installed in those buildings) it might then be possible to determine the best layout of the building relative to the operation of the occupants (e.g., to minimize path lengths, avoid congested areas, maximize space utilization, etc.). While such data previously was based on the architect's understanding of and experience with human activities in the buildings, *Big Data* in conjunction with agent-based simulations allows for putting the data of a firm numerical footing. Such simulations could not only be used to verify designs and argue for their efficiency, but they can also be used to explore design options, even if they are not currently legal or financially possible, and to communicate these design options to policy makers and investors in an effort to effect policy changes and possibly changes in market conceptions. This is particularly important in cases where common wisdom has prescribed preferences which were more based on intuitions than hard data (e.g., how wide a hallway must be in an office building for ensuring sufficient flow and safety).

3 Discussion and Conclusion

Overall, agent-based simulations combined with *Big Data* have great potential as part of an *urbanization science* where planning and designs of future living spaces are based on sound principles that are derived from large data and simulations. For architects, *Big Data* has the potential to remove ideological prejudices about the optimality, usefulness, and adequacy of designs, for results from agent-based simulations are generally taken to reveal “truths” that should be acceptable to all stakeholders (architects, developers, investors and city officials alike), as long as the model parameters are acceptable. By being able to appeal to these results, traditional design principles that are known to be inaccurate or problematic, but are kept because of lack of arguable alternatives, could be overcome and new design options introduced, thus allowing architects to employ designs they could otherwise not pursue. Hence, while agent-based simulations using *Big Data* might not directly affect architects in the same ways as urban and regional planners (i.e., by directly changing the way architects conceptualize buildings and spaces and thus develop their designs), these simulations might potentially do so *indirectly* in that that over time the new parameters and design options might have an impact on architectural thinking and theory, and thus designs down the road.

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Matthias Scheutz received degrees in philosophy (M.A. 1989, Ph.D. 1995) and formal logic (M.S. 1993) from the University of Vienna and in computer engineering (M.S. 1993) from the Vienna University of Technology (1993) in Austria. He also received the joint Ph.D. in cognitive science and computer science from Indiana University in 1999. Matthias is currently a professor of computer and cognitive science in the Department of Computer Science at Tufts University and an adjunct professor in the Department of Psychology. He has over 200 peer-reviewed publications in artificial intelligence, artificial life, agent-based computing, complex systems, natural language processing, cognitive modeling, robotics, human-robot interaction and foundations of cognitive science. His current research interests include large cloud-based computational models of complex systems.

Thomas Mayer received his masters degree in architecture from the Technical University in Vienna in 1993. He joined the Atelier Heiss architecture firm in 1996 and he has worked there since on a variety of design projects, ranging from small single family homes to large apartment complexes spanning several city blocks.

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II A 4
Game-based learning in systems thinking

Chairs

Fares Kayali, University of Applied Arts, Vienna
Peter Purgathofer, Vienna University of Technology
Peter Judmaier, University of Applied Sciences St. Pölten

Game-based learning is one of the current buzzwords almost everywhere, even if the successful examples are few and far between. The worldwide systems movement could greatly benefit from a critical survey of research and insight in this field, furthering the application of game based learning principles to various fields within the scope of the conference.

List of Contributors

Sonja Gabriel: Teaching human rights with video games
Nikolaus Koenig: System experience, systems thinking and computer games
Kazuhiro Ottomo, Shingo Takahashi: Model building game for facilitating group understanding of problem situation
Oliver Roider, Lucas Schöffer, Peter Judmaier, Christian Swertz, Frank Michelberger, Klaus Temper, Nicole Gallhuber, Sandra Wegener: "Bewusst mobil": serious gaming for sustainable awareness of active movability

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Teaching human rights with video games?

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Abstract: The last years have seen a rise in games that deal with human rights topics. However, that does not automatically mean that these games are suitable for teaching human rights. A grid that was developed in the project should help to evaluate the games.

Keywords: human rights, game-based learning, analyzing games, games for change

1 Teaching human rights with video games?

The so called games for change aim to change behaviour or attitude of gamers. This is why they go well with the aims of human rights education which is often divided into learning about, by and for human rights. Apart from attitudes and values human rights education also wants to teach competences and skills, as well as teaching basic knowledge and awareness. Human rights education wants people to reflect upon their ethical points of view. Finally empowerment of those concerned should take place.

Digital games for human rights education have been developed for more than ten years. “Escape from Woomera” (2003) is one of the early attempts to focus on human rights in a digital game. Players assume the role of a refugee in an Australian refugee-camp and experience life from this point of view. Although using game-mechanics of a typical adventure game “Escape from Woomera” was criticised as being too didactic as it imposes the designer’s opinion of what to think about life as a refugee in Australia. You can now find numerous games in the field of human rights and human rights education. Most of them aim at showing human rights violations by putting the player in the shoes of a character whose rights are violated or by having the player take on the role of a helper. Topics of these serious games range from situation of refugees in different countries, politics over poverty and child labour and exploitation to equal opportunities. Well known games in this field are Darfur is Dying, Food Force and Sweatshop. The last years have seen a rise in social games for teaching about human rights: Half the Sky Movement and WeTopia are played via Facebook. Mobile games like Phone Story (shows exploitation in the production process of mobile phones) made such an impact that it was even banned from Apple’s App Store. Few games really address schools and educators like the global conflicts series where topics like democracy, human rights, terrorism, globalisation, climate change and poverty are dealt with.

Although the games deal with similar topics and all of them try to teach players more or less about human rights there are huge differences regarding design. Some of the games are typical learning games and don’t offer much fun factor, other games try to be very emotional. Some games seem to do a good job conveying certain values and attitudes, however, when having a closer look they are not really useful for teaching human rights. Up to now there hasn’t been an attempt to examine digital games with regards their usability for teaching human rights (especially for using them in school lessons).

2 How to evaluate games

The research project that started in September 2013 as well as the presentation focus on the following: How are human rights (with a special focus on poverty) integrated in digital games? Can these games really help to reach the aims of human rights education? This means also looking at the link between game-design, topic and those values and attitudes the game wants to convey.

As a first step a grid for analysing games was developed. This grid analyses the following categories:

- Which (game) competence does the game demand?
- How many and what kind of choices can the player make?
- How is the relation among players? (Is there cooperation, competition?)

- What's the topic of the game? (Is there any relation to reality and to the aims of human rights education? How is the contents presented? What's the relation between contents and gameplay? etc.)
- What about rules and feedback? (Are there any contradictions?)
- Which emotional aspects does the game provide? (Is it possible to identify with the character? What about tolerance when making mistakes? Is there a fun-factor?)
- How complex is the game? (one or more story lines, relation between written and spoken text, single or multiplayer)
- What do you have to pay attention to regarding usage in school? (need to install the game, how long do you need to play to get the intention of the game regarding human rights)
- Pedagoy and didactic (is there additional material, background information, aims of the game / game-designers, which competences of human rights education are covered)

After analysing the results show if a certain game can help to teach / reach aims of human rights education and in how far it is necessary to have a good teacher who accompanies the process.

The presentation will give some examples and show different ways of presenting human rights topics in order to change the attitudes of the players or enhance their knowledge. The question if digital games are suitable for a real impact in this area will be raised.

About the Author

Sonja Gabriel studied English and German at the University of Vienna, did a master in Educational Media (University of Duisburg/Essen) and a master in Game Studies (Danube University Krems). Her dissertation about knowledge management in secondary schools was published in 2013. In 2011 she started working at the private teacher training college Vienna/Krems. She has been working on topics about digital games and their use in teaching contexts since 2008 in research projects and teacher training. Her current research topic deals with the topic of human rights in serious games.

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System experience, systems thinking and computer games

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Abstract: In this paper, a model of "System Experience" will be outlined and related to existing approaches in systems theory and systemy thinking. It will be argued how the act of playing computer games may challenge basic premises of existing uses of the system paradigm, and how a model of system experience might address these challenges. The paper wil conclude with suggestions how a model of system experience might heigthen an understanding of human experience by assuming a central role of the systems paradigm as a basic principle of human experience which goes beyond the deliberate and conscious use of the cognitive 'systems lens' prevalent in contemporary systems approaches.

Keywords: System Experience, systems paradigm, digital games, human experience, human cognition, media experience

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1 Introduction: the ambiguity of "Systems"

Since the mid of the past century, the idea of systems a productive concept to describe, assert and utilize a wide range of phenomena has become a formative paradigm in the philosophy of science, leaving its mark not only in natural sciences, but on sociological, psychological and cultural studies alike. When in the midst of the 20th century, western society encountered increasing problems in coping with the implications of technological development, the performance of natural sciences, the claim for global political perspectives and even the notion of social change experienced in terms of "revolutions", explanatory models that promised to account for this experience of increasing complexity were in high demand. "General Systems Theory" met this demand with the notion that a "systemic approach" might be better suited to address this complexity than the more traditional "analytical method", and has quickly become a persuasive paradigm not only within academia, but - in the form of slogans like "the whole is more than a sum of its parts"[1] - also within everyday knowledge.

But even though the idea of systems seems to have pervaded our lives and our ways of thinking, the implications and even the premises of this idea are highly ambiguous. When Ludwig von Bertalanffy formulates the basic claim of General Systems Theory by stating "Systems Everywhere"[2], this claim is not as simple and self-explanatory as it may seem: where do these systems come from? Are there "systems everywhere" in the world around us, which we need to identify and understand? Are we supposed to understand the world in systemic terms, in order to better manage our perceptions by assuming "systems everywhere"? Or can we choose to see the world in systemic terms, and will therefore find "systems everywhere"?

2 Application of the systems paradigm

2.1 Systems in the 'real world'

This ambiguity marks a variety of different applications of the systems paradigm, ranging from the assumption of systems as an occurrence of the "real, natural world" to the idea of systems as a cognitive lens. When Sociologist Talcott Parsons devises his "Theory of Action", it is made clear that the systems to be observed are conceived of as rooted "in the physical world and the living organism"[3] and even though such a naturalist view may seem outdated at first, the idea of "natural systems" has been employed deliberately and as a pragmatic tool even by those who refute the idea of objective reality on an ontological level[4]. When epistemological questions are put aside, the idea of natural systems proves even more persistent when it comes to the increasing importance of (digital) simulations in the social sciences, technology, economics and even game design, as the whole idea of "simulation" is based on the identification of a core system (i.e. 'real system') which is (partially) re-modelled in an artificial environment.

[1] Bertalanffy, 1971.
[2] ibd.
[3] Parsons, 1951.
[4] see: Luhmann, 1995.

2.2 The systems lens - systems thinking

While the idea of "real, natural systems" is not necessarily in opposition to the notion of systems as a lens through which the world can (or even should) be perceived, the latter approach shifts the attention to a different question: instead of asking for the existence or behavior of "real, natural systems", it regards the systems paradigm as a cognitive organizing principle, which (in compliance with the initial aim of General Systems Theory) promises a better (i.e. more successful) understanding of the world around us. This is the basic premise of "systems thinking", which promotes a systemic perspective, even though the existence of "real, natural systems" is not necessarily assumed: "Systems thinking" simply "structures thinking about whatever entity or phenomenon we become aware of and assign meaning to."[5]. While the assumption of "real, natural systems" makes claims about the ontical world, systems thinking is regarded as "a property of the thinker, who organizes internalized systems ideas, systems concepts, and principles into an internally consistent arrangement, using a systems way of viewing and understanding, in order to establish a frame of thinking."[6] In this understanding, we can choose to take a systemic perspective on the world, and we can take it consciously and deliberately, as long as we are properly taught and trained to do so. With this claim, systems thinking not only marks the systems paradigm as "a property of the thinker", but also as a deliberate perspective which, when taught and trained properly, promises to heighten our ability to successfully act and reflect upon our perceptions of the world. With this, systems thinking also implies an educational claim and, finally, the idea that digital games can help to teach and train a systemic perspective.

2.3 The Challenge - (digital) Games and the Systems Paradigm

But when digital games and acts of gaming are examined closely, it becomes obvious that the relation between digital games (i.e. interactive systems) and the systemic paradigm may even be more significant. While digital games most certainly require players to show a high degree of systemic awareness, the one thing that stands out the most is the great ease with which humans seem to interact with a system, as soon as it presents itself in an interactive, operational and functional way. It is this ease of systemic interaction which raises a crucial question: does a systemic perspective need to be taught and trained in the first place? Or may the systemic paradigm be more familiar to us than we even seem to know?

This ease of systemic interaction is especially emphasized by, but not exclusive to, digital games, and it challenges basic assumptions underlying our current idea of "systems thinking": if humans are so adept in dealing with interactive systems, can the systemic paradigm still be regarded as as deliberate tool, as a lens which can be taught, trained and activated on a conscious level? Or can it be assumed that human cognition is already deeply attuned to the logic of systems? Is the systems paradigm more deeply rooted in human experience than systems theory or even systems thinking suggest? Is it possible that computer games are not simply training grounds to change the way we think, but that they are already inherently "[…] oriented toward human experience and ideas, much more so than other kinds of software."[7]?

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[5] Banathy, 1996.
[6] ibd.
[7] Bogost, 2011.

3 System experience

3.1 Defining system experience

Based on the assumption, that the systems paradigm is more deeply rooted in human cognition than existing applications of the paradigm suggest, an alternative model called "System Experience" has been developed, which deviates from existing applications of the systems paradigm in the following regards:
(1) System experience is a model of human experience, not a model of systems. It does not deal with the experience of systems, as no assumption about the existence or non-existence of systems in the 'world' is made. Neither does it suggest to approach human cognition as a system. Instead, system experience is based on the assumption that human experience gives rise to the systems paradigm; human cognition is understood as the terms and conditions leading to the systemic organization of perceptions: perceptions are organized as if they were perceptions of systems or parts of systems.
(2) System experience is regarded as a general condition of human cognition. It is not restricted to conscious thought or reflection. System Experience argues that human experience is based on the intuitive assumption that the world is organized in systems, and that every perception is intuitively assumed to be part of a system; this intuitive assumption is not confined to conscious reflection.
(3) System Experience, therefore, is assumed to be a general human trait. It does not promote the systems paradigm as a tool to be applied to methodical examination at will or implicate that it can be dismissed deliberately. From this perspective, methodical approaches explicitly employing the systems paradigm (e.g. 'systems thinking') are not regarded as unique because they are organized in systemic terms, but because they make the terms of conditions leading to the systemic organization of any cognitive endeavor explicit.
Based on these premises, the basic claim of "System Experience" can be subsumed as follows:

"Humans organize their perceptions as if they were systems, or parts of systems".

3.2 Indetermination of Systems of Experience

The idea of System Experience suggests that human cognition is intuitively oriented towards the assumption of systems. It has to be noted, however, that these assumed/experiential systems can not be discussed in equal terms as common notions of the term "system" suggest. Most importantly, contrary to prevalent notions of systems, assumed/experiential systems lack functional completeness. While any 'natural system' is supposed to be 'complete' in order to function as a system, assumed/experiential systems are generally in-determined,
The indetermination of assumed/experiential systems can be illustrated by the example of a gardener building a garden-fence - continuously driving fence posts into the ground along a straight line. But instead of using a whole batch of fence posts, the gardener always uses the same one: every time she gets down to driving the 'next' post into the ground, she absent-mindedly reaches back, plugs the last post from the earth and drives it in the next designated spot. The gardener is at every given moment engaged in the act of building a fence, but at the same time never actually building it. Still, the experience is one of building, based on the assumption that the current post is the link between a previous post and the

next one - and as long as the gardener holds on to this assumption, the act of ‘building’ the fence is a meaningful activity.

4 Conclusion

Due to the indetermination of assumed/experiential systems, it is necessary to give up the idea of ‘functional completeness’ as a defining characteristic of systems, before the systemic disposition of human cognition can be assessed. This is, however, a worthwhile undertaking within the field of systems theory, as it is suited to makes the deep relation between human experience and the notion of systems tangible.

While this challenges the idea that digital games may be used to teach and train systems thinking, it may also show that the systems paradigm is not so much in need of teaching and training in the first place. However, the relation between digital games and the systems paradigm may again be revived, as a closer examination of games in the context of systems may be an excellent way to further unravel the ways we can think about and experience the world, and how we tend to “make sense” of our experiences.

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Model building game for facilitating group understanding of problem situation

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Abstract: This paper proposes a group modeling game that facilitates the group members in the process for understanding the problem situation. This process is basically organized according to the group model building developed by Vennix. The group model building provides a way that each problem holder who is a participant of a discussion first builds a causal diagram of System Dynamics reflecting his/her own view, then under a skillful facilitator the participants build a unified diagram so that they could share their views. The group modeling game proposed here plays a substitute role of the facilitator in the group model building method. Then by using the group modeling game the participants could build a unified diagram without a skillful facilitator. This paper also confirms the effectiveness of the proposed method by performing a subject experiment.

Keywords: model building game, facilitation, gamification, group model building

1 Introduction

We propose a gaming methodology that facilitates the group members in the discussion process for understanding the problem situation through developing a unified causal loop diagram usually used in system dynamics as a group of the problem holders involved in the problem situation.

Our gaming methodology, named Model Building Game, is basically organized according to group model building developed by Vennix [2]. The group model building provides a way that individual causal diagrams expressing his/her own view and understanding of the problem situation are unified so as to share the group recognition of the situation among the problem holders by building a unified causal diagram. The sharing process of the recognition is performed under a skillful facilitator. The outcome of the process of group model building strongly depends on how the facilitation works. The group modeling game proposed here plays a substitute role of the facilitator in the group model building method. Then by using the group modeling game the participants could build a unified diagram without a skillful facilitator. This paper also confirms the effectiveness of the proposed method by performing a subject experiment.

2 Comparison of model building game with group model building

The main process of model building game is essentially shared with the group model building except facilitation. Here we compare the two processes of MBG and GMB to understand the essential idea of MBG (Fig.1).

First we describe briefly the process of the group model building. The group model building starts with the step in which each problem holder draws a causal loop diagram individually that reflects his/her own view of the problem situation. Then a skillful facilitator supports the discussion by the problem holder to unify their diagrams to build “one” unified diagram as a group. The facilitator provides the problem holders with the viewpoints on where they should look at in the diagram, or promotes the sharing process of the problem holders’ recognitions. Hence an essential problem is that the outcome of GMB strongly depends on the skill of the facilitator.

The model building game exploits the concept of gamification [3] to modify the facilitation process into a card game rule. Playing the game provides a skillful facilitation process. The problem holders build their unified diagram by playing the game. The game rule is created from the criteria that realize the essential points of facilitation: the viewpoints where to look at in the diagram and the way how to explain his/her action.

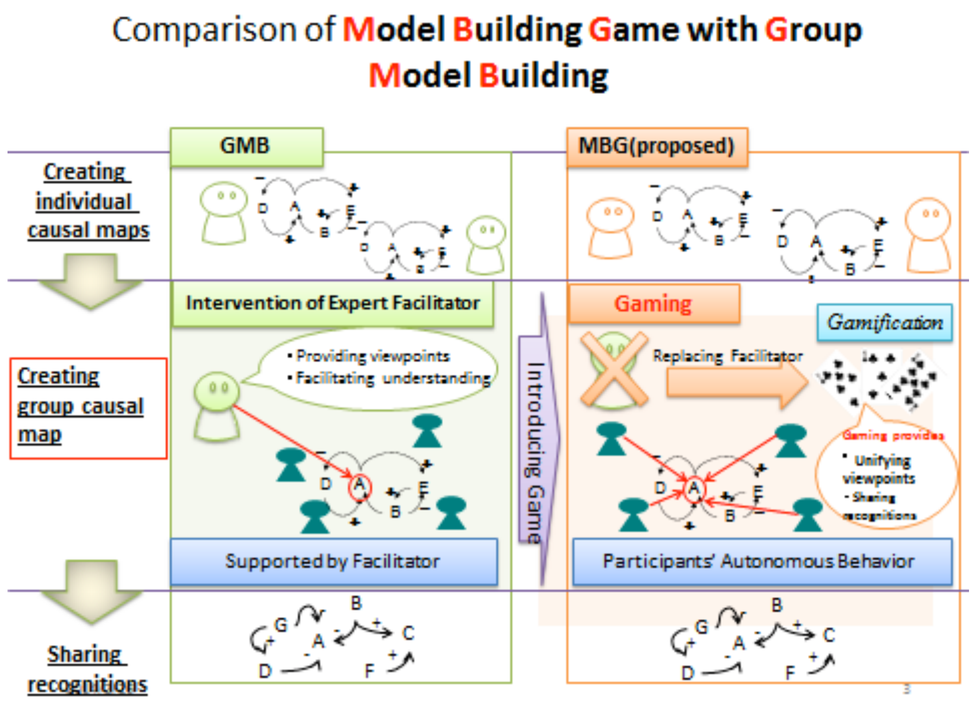

Figure 1: Comparison of Model Building Game with Group Model Building

3 Steps of model building game

Here we describe briefly the steps of model building game.

The purpose of the game is to get a higher point by making the poker-like hands. Making a hand corresponds to one of the good skill of the facilitation. A player can get a card to make a hand by making a good action to improve the diagram. The criteria of the goodness of the actions are realized as the game rule. As the result of the game, the actions pursuing the higher point improve a causal loop diagram.

The MBG consists of 7 steps. The actions involved in the steps correspond to get a card to make a hand (Fig.2).
Step1: Sharing individual causal loop diagrams.
Step2: Determined a starting variable (1).
Step3: Identifying variables (2) as many as possible causing the starting variable (1).
Step4: Linking variables (2).
Step5: Identifying variables (4) causing or resulting the variable (2).
Step6: Identifying variables (5) resulting the variable (1).
Step7: Refining the diagram.
In the steps from 4 to 7, if a player makes “three-card hand” or “straight flush hand”, then he should explain the diagram.

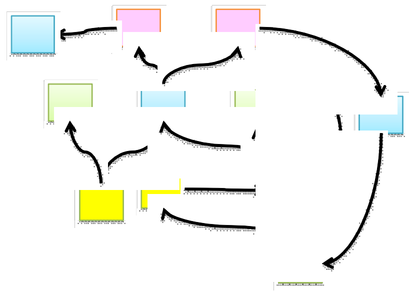

Figure 2: Steps of Model Building Game

4 Experimental results

We conducted experiments to confirm the effectiveness of MBG. We testes three hypotheses:

1. Examinees can get deeply involved in making the model with game than without game.
2. Examinees can make a better diagram with game than without game.
3. Examinees can gain a better understanding of the problem situation.

The experiments were performed by 35 graduates and undergraduates who were assigned to 7 groups of 4 players and 1 recorder.

The results are given as follows:

1. In the debriefing process a questionnaire was carried out to the examinees. Over 80 percent of the examinees of MBG answered positively while the answers of the examinees of model building workshop without game varied widely.
2. We compared the number of variables in the created diagram with that in the reference diagram that is obtained from GMB with a facilitator. This hypothesis is based on the idea that a better diagram consists of more variables. The results supported the hypothesis.
3. Also in the debriefing process a questionnaire on how good the examinees understand the problem situation. We especially compared the answers of the group with game and the group without game. Then most of the examinees of the group with game could find new aspects concerning the problem situation and get deeper understanding while not many of the examinees of the group without game could get deeper understanding.

We can conclude from the above experimental results that the model building game can provide a good way to play a substitute role of the facilitation in group model building.

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"Bewusst Mobil": serious gaming for sustainable awareness of active movability

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Abstract: Mobility behavior is formed during infancy and later on, as a teenager trained further. Whoever is used to sustainable mobility behavior during childhood will stick to those manners. “Bewusst Mobil” aims to develop age-based educational measures by using modern information technology and the popularity of computer and smart phone games for a pedagogic and consciousness educational purpose. The project issue is to define the requirements, regarding content and technical realization of child friendly measures and to design a prototype of a computer game for teenagers.

Keywords: Sustainability; Serious Gaming; Game-based learning; Locomotion; Awareness; Active mobility; Ubiquitous Gaming; GPS Tracking algorithm; Activity Recognition;

Acknowledgement: This project was founded by FFG - Austrian Research Promotion Agency/Federal Ministry for Transport, Innovation and Technology in the program ways2go.

1 Intention

Choosing means of transportation is relevant for the environment. Still, the impact of education on that topic has hardly researched yet (Rickinson 2001). The possibilities of serious games for teaching an environment-friendly choice of means of transportation in environmental education have not been researched yet. “Bewusst Mobil” is a project with the target to make people more aware of using different ways for locomotion within their daily routines.

There is one quotation which describes the problem very well: "Man is a creature of habit”. This experience has been scientifically proven and applies also to mobility patterns. There is another saying that describes the main approach of the project: "You can't teach an old dog new tricks". Both statements apply to a large extent to the mobility behavior of human beings. It is the long term aim to move as many people as possible to sustainable forms of mobility. This has to be done at a very early stage in life. Successful and sustainable measures already need to be set in childhood and adolescence if possible. Within that it is essential to not only teach young people on an educational level but to show them in other ways that sustainable forms of mobility are fun and can be really cool. Likewise, the spirit of discovery and research of young people must be used. Therefore the aim of the project is to develop and test a game design that raises the awareness of sustainable forms of mobility forms just by playing a game.

2 Gaming as a serious method

The relevance of behavior for the environment is obvious and consequently an issue for environmental education since the early beginnings in the 1970s (Hesselink/Čeřovský 2008). Childhood and youth can be considered as highly relevant in this respect, since the trained behavior and learned attitudes during a lifespan create a Habitus, which can hardly be changed with adults due to the hysteresis of the habitus (Bourdieau 1979). Thus, teaching environmental friendly choices of means of transportation is considerably relevant during childhood and youth. While games in teaching and learning have been discussed in the educational sciences since the 18th century (Parmentier 2004) and combined with computer technology since the 1970s (Papert 1980), research in computer games as an academic and scientific aspect did start not until 2000 (Chang & Wang & Lin & Yang, 2009). Since then, development processes of traditional e-learning technologies have started and after 2004 they began to be combined with well-known customary, pure entertainment-based forms of videogames (Chang et al., 2009). These new gaming methods finally have led to new possibilities for conveying knowledge of a huge range of topics to either public or also very specific groups of persons.

2.1 Awareness by unconscious learning

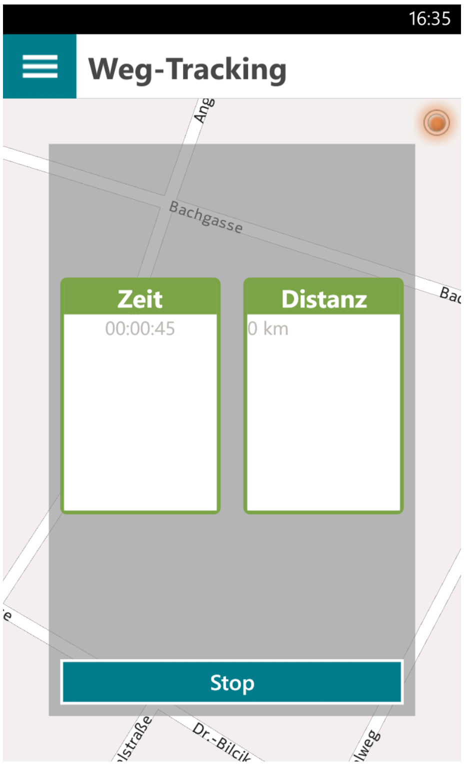
This evolution led to what is commonly known today as “serious gaming concepts” and brought the opportunity to transfer knowledge in an unconstrained gamified way. It has also become more and more important as a method to sensitize people’s awareness on specific topics and domains.

With this in mind, “Bewusst Mobil” was initiated and intended to make people more conscious of using different ways for locomotion in an unconscious way. To realize this intention, several ideas for a practical game based learning concept have been discussed and analyzed.

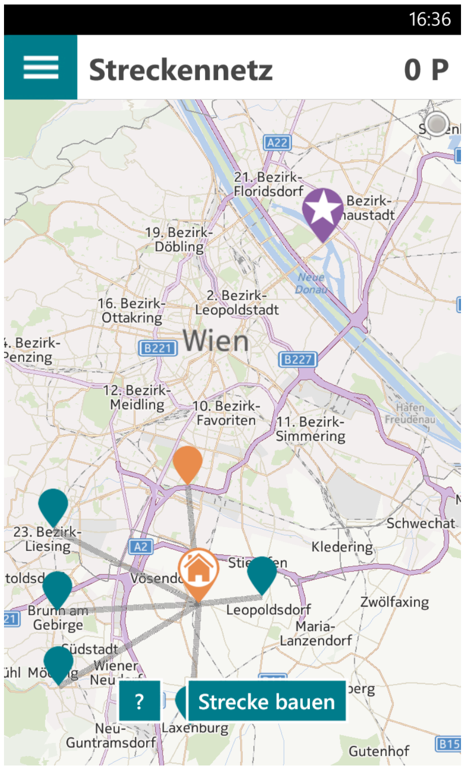
2.2 How the team combined gaming with moving in nature

The goal of „Bewusst Mobil“ is to make the players more aware of their different possibilities to travel various distances and ways.

To do so, we implemented a GPS-based tracking system, which records the distance of the players’ trips, as well as the time they need to reach their destination. By using an Activity Recognition algorithm, we can determine the mode people are using for their trip (for example car-use or walking). Depending on the distance and their means of transportation, they gather points for the continued game. These points are based on data for sustainable mobility and consider healthy factors, too. The project team is working on developing an easy understandable and playable model for the complex impact of locomotion on ecology and humans. Players get notably more points for walking or cycling at a longer distance, than they would get, if they use a car, a bus or a train instead. The points can be used in the second layer of the game, where the player can redeem these points to erect a virtual transportation network. Finally, if this network has reached a specific destination (called „Event“) the player will win real goodies. This hunting of events is the main gameplay.



(Figure 1, The GPS-based tracking system)



(Figure 2, Building a virtual transportation system)

2.3 The effect

Generally, sustainability means preserving the needs of future generations. Although the term is used with an inflationary meaning nowadays, the most common definition of sustainable mobility considers ecological, economic and social aspects, for which it is necessary to find appropriate indicators and evaluation methods to assess sustainable behavior. Playing the game should eventually lead to sustainable behavior in a long term perspective, resulting in better living conditions due to the reduction of air and noise pollution, congestion and space required for cars. Moreover, fostering active mobility, like walking and cycling, has a valuable impact on people's health, reducing economic healthcare costs.

2.3 Testing game and conclusion

Games offer good opportunities to transfer knowledge about sustainable mobility to young people, because they make it possible to impart complex systems in an easy way and to experience them by direct interaction. Additionally "Bewusst Mobil" provides the opportunity to raise awareness for healthier and ecological sustainable forms of locomotion. This is caused by the involvement of the players' mobility in a real natural environment, within the game. In the context of the project, two separate tests with scholars of Austrian public schools will be performed. So the project team can eventually verify if the game design is well received by the target group and the desired effects can be achieved.

The conference presentation will give background information about measuring sustainable mobility and will show a prototype of the game, explaining the data generation and the development of the game rating system.

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II B
Emergent design

Chairs

Martin Fössleitner, Gesellschaft für angewandtes Informationsdesign mbH
Thomas Fundneider, theLivingCore

In the past, design was mostly related to products, or –more recently– to services. Furthermore, the main activity of designers was "beautification" of the product or the service. As a consequence, design has been regarded as something finished – the user may like and use it, or not. Recent definitions put the focus on the design process. Contemporary approaches see design as a platform or mediator for social interactions. Design which triggers interactions and acts as an incubator for future activities is no longer a static manifest, but a very dynamic system. It is the result of the participating people and the context, so that the outcome is in many cases unpredictable, unexpected and open. Soichiro Fukutake calls it "Use what exists to create what is to be". In this workshop we will build on the foundations of systems sciences by the following attitudes and frameworks:

- Awareness through observation of surrounding elements
- Exploring an attitude of enabling
- Assets and capabilities combined with the skills and knowledge how to detect potentialities and develop concepts and solutions

The workshop "Emergent design" will cover design/innovation methods and tools of exploration, participation and testing. The participants will work on a selected case/problem/etc. and will be guided by the workshop chairs putting the mentioned methods and tools into practice.

List of Contributors

Alessio Erioli, Niccolò Amaducci: KUURA: application of diffuse limited aggregation model in generative project strategies
Stefan Blachfellner, Franz Tramberger: Design works: business model innovation and emergence
F. Markus Peschl, Thomas Fundneider: Designing incubation spaces for thriving innovation communities
Michael Heather, Nick Rossiter: The system as emergent process in Topos theory

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KUURA: Application of diffuse limited aggregation model in generative project strategies

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Abstract: this paper focuses on the form generation potential and architectural impact of the Diffusion Limited Aggregation(DLA) model, as material accumulation and aggregation based process. Using a digital simulation approach of the growth process based in generative algorithms, the outcomes are assessed from the functional, design-oriented and aesthetic standpoints through th case-study of an Aurora Borealis observatory.

Keywords: architecture, DLA, simulation, Processing, integrated envelope, generative algorithms, aggregation based process, bottom-up desig.

Acknowledgement: I would like to thank Università di Bologna and DAPT department for supporting my work.

The KUURA (Finnish word that refers to frost formation by sublimation of vapor into ice) project investigates the potential of formation processes by aggregation and accumulation and their application impact in architecture. The research focuses on Diffusion Limited Aggregation (DLA) process, simulated through behavior based generative algorithms. The application case study is the proposal for an aurora borealis observatory in Rovaniemi, in which multiperformance properties of the envelope are mandatory, as it must convey climate control function (a mandatory demand in such an extreme enviroment), structural capacity and perceptual immersion with the sky and the environment altogether. DLA's own capacity to modify and differentiate its constitutive growth pattern according to exogenous conditions can be exploited in structural and aesthetic-perceptual terms, allowing for the creation of a continuos yet heterogeneous performance, within a coherent and systemic outcome.

The DLA process is based on Benoit Mandelbrot's essays about the fractal dimensions and their application to the probabilistic field; it is a sistem based on fractal propriety, with an own internal homotety. Such system owes its first algorithmic formulation to Lyndenmayer's work on L-Systems code (see the essay "The Algorithmic Beauty Of Plants") as well as to Witten and Sander's proposal about a language to simulate natural aggregation phenomena, such has the "Hele-Shaw flow", the electrical breakdown or frost formation (Kuura).

DLA simulation considers the diffusion in a confined space of free moving particles able to lock one with the others. The probability of aggregation in a certain volume increases with the growth of the existing aggregate, while retaining similarity in the generated form: the spatial density of the generated system is the same at every scale (identified by the Hausdorff dimension of 2.50), thus revealing the fractal nature of the process. For the KUURA project, algorithms for the generation process were implemented from the ground up in the Processing programming environment, as it allowed an Object-Oriented implementation as well as the flexibility required to instrumentalize the process for design purposes. It also permitted the implementation of a seamless iterative workflow between computation, visualization and evaluation. Starting from Witten and Sander's formulation, the process was then simulated in several benchmarks, from 2D to 3D; subsequently, parameters driving the aggregate growth and structure were identified and systematically varied in order to generate populations of differentiated growth, record the outcomes and build a comprehensive landscape of the system potential. In detail, these variables are distances and interaction angles between the particles, growth speed, motion quality of the free particles. In the following phase, feedback was coded in order to affect DLA growth parameters with environmental and functional-perceptual variables (such as the great importance of the sky view), through intensive force fields.

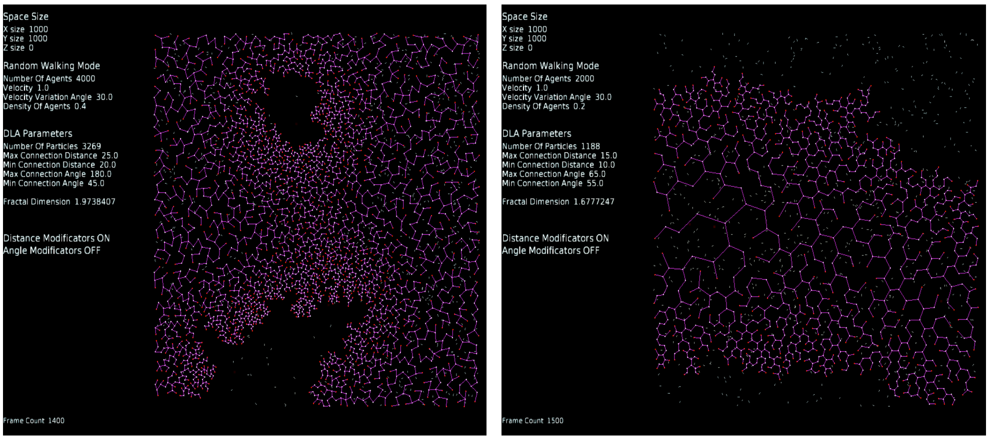

Figure 1-2: DLA test with feedback from an intensive force field (KUURA thesis, 2013)

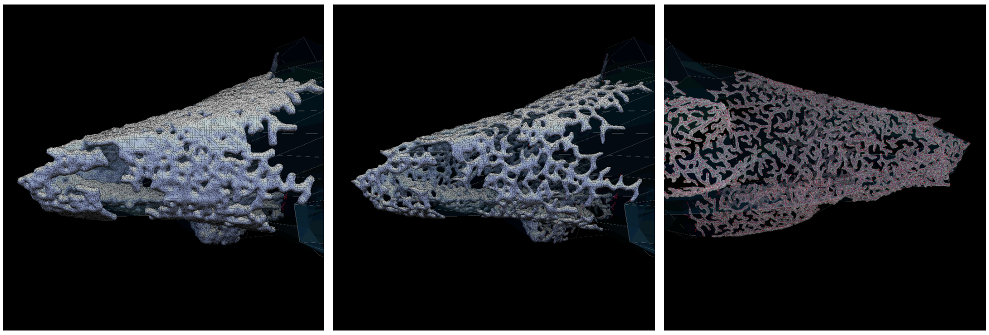

Figure 3-4-5: Samples of structural thickness and morphology adaptation(KUURA thesis, 2013)

A couple more strategies were implemented in order to define the envelope and the embedded data necessary to define the environment for the DLA proliferation: an agent-based stigmergy process was also designed for the urban scale process and to generate the necessary constraint from the terrain to the observatory, while the massing phase was developed through a semi-rigid topology (designed according to function and circulation patterns) influenced by wind simulation, as the strong wind is a main environmental factor that drives, together with temperature, gradient of frost formation.

After the envelope resolution, the skin was subjected to an evaluation process, simulating solar radiation conditions and visual performance, in order to control the DLA growth, global and local density and branch structural thickness, fitting the system on exogenous conditions.

While perceptual qualities could (and necessarily needed to) be verified through visual assessment on the process output (also by means of a 3D-printed model), structural and thermal performances require further investigation that hasn't been implemented yet at this stage, but will be object of future development. However, factors such as the degree of connectivity in specific ares, thickness and density distribution over the skin areas with relation to environmental data, both in the digital and printed model already give clear indicators on the distribution of qualities and critical situations.

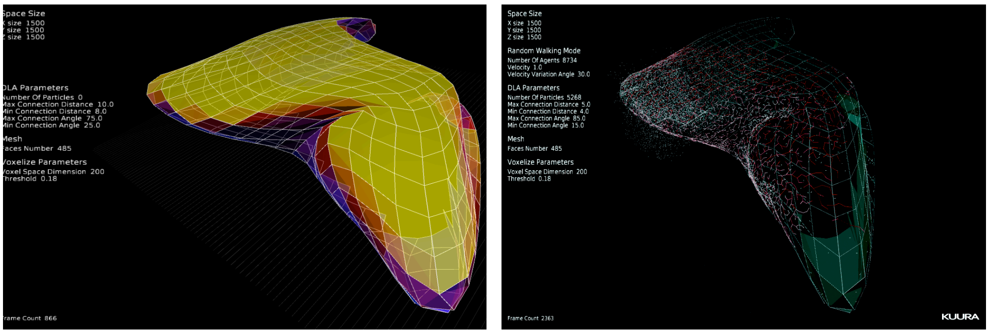

Figure 6-7: Environmental variable feedback on DLA process (KUURA thesis, 2013)

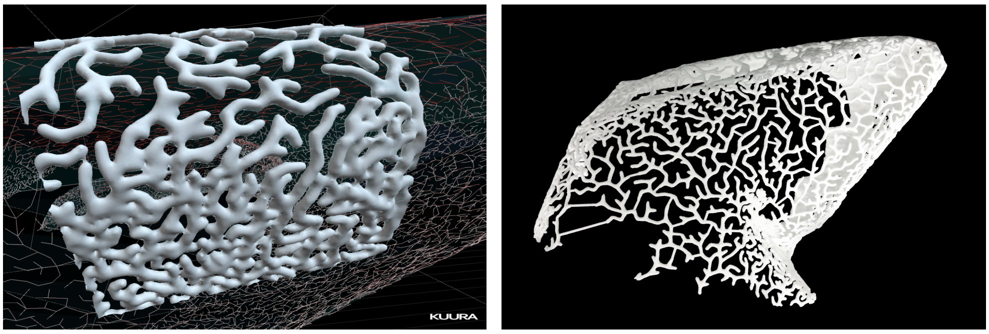

Figure 8-9: Structural samples and physical 3d-printed model (KUURA Thesis, 2013)

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Design works: business model innovation and emergence

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Abstract: The extended abstract “Design works: Business Model Innovation and Emergence” elaborates a design approach for business model innovation that takes emerging complexity into account and aims at real value creation for multi stakeholders. This approach has been prototyped in a University masters course and has since been tested and improved several times in the field.

Keywords: startup; business; innovation; design; emergence; business model innovation; value proposition design; value creation; co-initiating; co-sensing; co-creating; co-evolving; feedback learning loops

Entrepreneurs with startup ambitions as well as established businesses are in need of radical innovations to position their ventures in today´s competitive markets. Societies and customers demand businesses to provide solutions for real societal problems. Only those ideas which meet such demands are recognized through their real value creation by all involved stakeholders. The following extended abstract elaborates a design method that was prototyped in a master thesis by Franz Tramberger, supervised by Stefan Blachfellner based on his entrepreneurship masters course at the Upper Austria University of Applied Sciences Campus Steyr, and has since been tested in the field for many times.

1 Starting a business with a design approach

The predominant paradigm in today's business is innovation. But most innovation is blind in the sense that it does not take into account the real needs of the customers and their societal context. Thus most innovation approaches rely on a "design for" approach rather than a "design with" (the people) approach. Allee Verna (2003) claimed that the future of management thinking lies in the deep understanding of living systems. Beginning in the 90s of the last century she witnessed the trajectories of integrating systems, renewing values and creating a union with life in management approaches. Violeta Bulc (2012) states in a more recent publication, organizations will evolve from thinking environments into self-conscious environments, from innovation driven into intuition driven organizations. Not only people will be the source of value creation, but opportunities that are constantly perceived and taken into account. Such a paradigm is in need of a design approach that enables decision makers to constantly align their business models with these emerging opportunities. Entrepreneurs need to understand emergence as a rich well for their value creation. Design thinking has established a pragmatic understanding of emergence and how it must be integrated in design. Although it never addressed the phenomenon specifically, the process of understanding through observation, conceptualization, validation and iteration, before an implementation (Clark, K. & Smith, R. 2010) changed business development significantly and shifted the prevailing paradigm of strategic management into an opportunity increasing future oriented design management. Otto Scharmer (2007) introduced a similar approach although disconnected from the trend of design thinking. His "Theory U" proposed five steps of leading from the future as it emerges: (1) Co-initiating – listen to others and to what life calls you to do, (2) Co-sensing – go to places of most potential and listen with your mind and heart wide open, (3) Co-presencing – retreat and reflect, allow the inner knowing to emerge, (4) Co-creating – prototype a microcosm of the new to explore the future by doing, and (5) Co-evolving – grow innovation ecosystems by seeing and acting from the emerging whole. This sensing and presencing approach should be a guideline to work with the emerging complexity to curate disruptive patterns of innovations and change (Scharmer, 2007). A combination of both approaches, the systems thinking informed "Theory U" and design thinking informed "Design process" is setting the stage for a more detailed step by step design process to evolve creative and conscious business models.

1.1 Design a working value proposition by co-initiating and co-sensing

The core of any business design is the value proposition. We have combined four well known approaches into one working tool box.

Günther Faltin (2008) shares his experiences and ideas of the entrepreneur as a composer who curates existing opportunities in alignment with what life calls the entrepreneur to do. He advises to start with an approach he calls “function versus convention”. To start with a business design the entrepreneur should observe existing problems and solutions similar to Scharmer´s (2007) co-initiating and co-sensing and carve out the demanded functions to identify sources of value creation. We have combined the outcome of his approach with two tools of the blue ocean strategy by Kim & Mauborgne (2005): Mapping the value propositions onto the blue ocean “Strategy Canvas” and redesign the value creation by using the blue ocean “Four Actions Framework” proposed to create a value innovation.

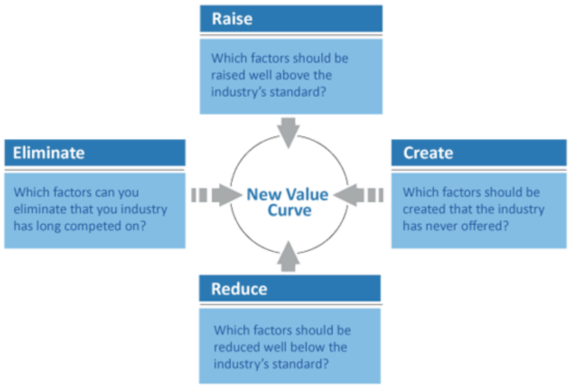

Figure 1: 4 Actions Framework (Blue Ocean Strategy, 2014)

Thus cost savings are possible by eliminating and reducing the factors an industry competes on and customer value is lifted by raising and creating elements the industry has never offered (Kim & Mauborgne, 2005). The results are then further elaborated in a newly introduced tool called “Value Proposition Canvas” (Osterwalder, 2012).

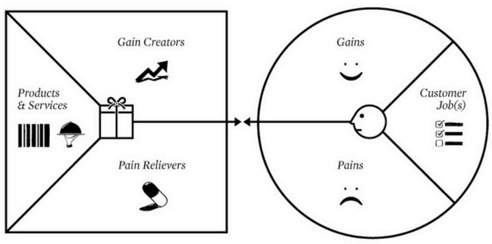

Figure 2: Value Propoistion Canvas (Osterwalder, 2012)

Although again the tool itself never explicitly addresses the phenomenon of emergence and focuses on the idea of product market fit, it can be argued that a perfect product market fit only exists if the emergent complexity Otto Scharmer (2007) addresses is taken into account. In detail it offers a mapping tool that forces the entrepreneurial designer to focus on the customer’s full life context, the real needs and even motivations, called customer pains and gains in the tool. An extensive research informed by cultural anthropological methods and several methods from designing thinking is needed to answer these questions in detail. Thus the products & services include the insights of the analytical and creative approach of the blue ocean strategy canvas and the customer insights from field research.

One may argue that the approach so far is still a design for customers. But we argue that from scratch potential customers should be involved in the design with a sound customer development process (Blank & Dorf, 2012) that ensures customer discovery and customer validation leading into the iteration of the value proposition by pivoting it until the most impactful hypotheses about the customer needs and behaviors are proven. Thus the people for whom we want to create value are already designing with us the most exciting value proposition for themselves.

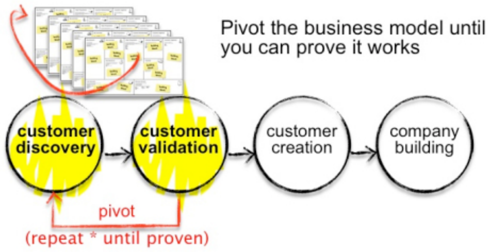

Figure 3: Pivot the business model (Blank & Dorf, 2012)

1.2 Design the business model innovation and deliver customer experience by co-creation and co-evolving

If the value proposition in phase one is validated as a promising business opportunity, we propose to develop the business model innovation using the already well known tool within startup communities called “Business Model Canvas” by Osterwalder & Pigneur (2010).

An interdisciplinary team focuses on all key elements within a working business model. Based on further hypotheses the team starts to design the overall experience with sound insights of customer segments and the validated value proposition designing customer relationships and channels plus the assumed revenue streams. Then the team focuses on the key resources and key activities as well as the key partners necessary to provide the expected solutions reasoning the assumed costs structures.

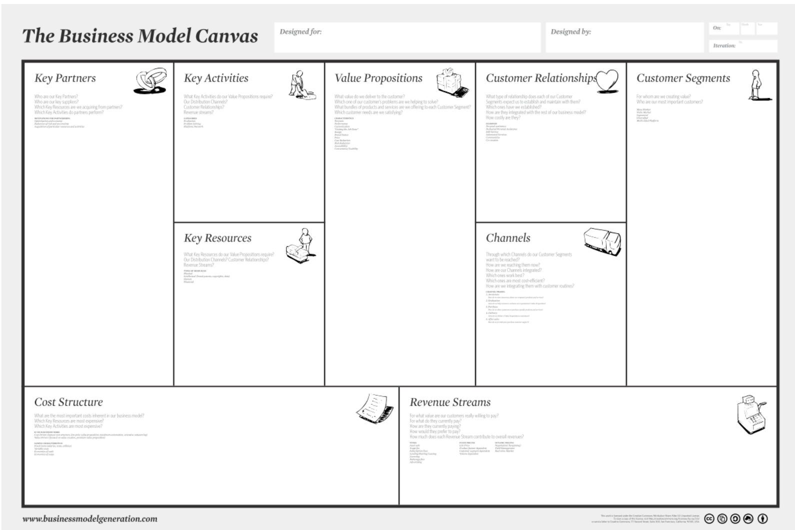

Figure 4: Business Model Canvas (Osterwalder & Pigneur 2010)

The first business model design is still a pivot. To ensure the validation of the business model hypotheses the venture team must follow the customer development process (Blank & Dorf, 2012) and offer a so called “Minimal Viable Product” (or service) to start lean (Ries, 2011) and co-create the first prototype or microcosm of the new to explore the future by doing (Scharmer, 2007). Thus lean startups deliver value from day one. They experiment and co-evolve with their multiple stakeholders in an innovation eco-system. But a true experiment follows a scientific method. The co-evolvement is supported by a build-measure-learn feedback loop (Ries, 2011).

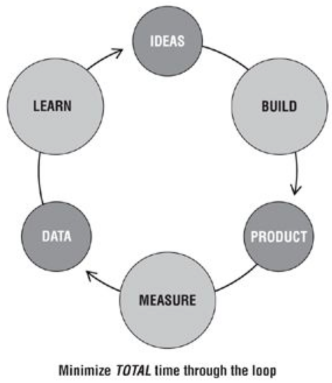

Figure 5: Build-Measure-Learn Feedback Loop (Ries, 2011)

This feedback loop is essentially a “design with” approach. It may influence the core of the business, the value proposition in details, or lead to a pivot of the overall business model and experience. Combined with the customer development process the build-measure-learn feedback loop ensures the validation of all hypotheses while providing value for the customers and growth for the business venture with opportunities experienced in real time.

Any business design following these steps we have conducted so far has minimized its risks and increased its success rates through a co-evolving approach. Opportunities have been identified from the existing patterns, the design process is an ongoing co-creation with multiple stakeholder approaches and the already existing patterns are curated into the new as it emerges. Thus we would like to call this approach an emergent design.

1.3 Conclusion and outlook

While we already have feasible methods to deal with emerging complexity in a business environment, identify opportunities, and design experiences, we are still in need of a better understanding of social emergence as a phenomenon and how to improve our design work. Some argue the interface between systems science and design is already in place. We hope that with the upcoming European Meetings on Cybernetics and Systems Research 2014 this interface itself starts to emerge (again) and starts to enrich design practice in a fundamental way. We want to contribute to a different narrative than Tim Jackson (2010) once phrased in his TED talk: “It´s a story about us, people, being persuaded to spent money we don´t have on things we don´t need to create impressions that won´t last on people, we don´t care about”.

We want to improve individual, communal and ecological flourishing with our designs. We are aware that we are systems designer influencing more than just the success rate of one business. Thus we are searching for an interdisciplinary exchange and the opportunity to co-create further working insights for emergent design to consciously deal with what life calls us and others to do.

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I am founder and Managing Director of Stefan Blachfellner Consulting e.U. - b-original Business & Communication Design. Since 1999 I have worked as a business developer and consultant with broad experience in Fortune TOP 500 industries, and the service sector as well as in public administration and cultural and educational organizations. Since 2013 I am appointed as Managing Director of the Bertalanffy Center for the Study of Systems Science in Vienna.

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I am one of the co-founders of the international Change the Game Initiative, where paradigm changers meet. I am an active member in several international scientific communities dedicated to social and technological innovations and systems science and research. I serve the International Federation for Systems Research as Vice President (2012-2014).

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Designing incubation spaces for thriving innovation communities

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Abstract: This paper presents the design of an urban structure for about 1000-2000 persons originating primarily from the so-called creative class, a creative settlement. This settlement provides a smart working environment for innovation (driven companies) and start-ups, an area for high quality living as well as for leading edge education. Both, the theoretical concepts, their background, and the research-driven design process having lead to this creative settlement are presented. The methods applied in this approach include ethnographic methods, qualitative interviews, quantitative surveys as well as approaches from design thinking.

This paper represents a case study applying and explaining theoretical concepts form the Enabling Spaces approach. A balanced and sustainable research-based ecosystem integrating the poles of innovation/creativity, qualitative living, and high quality educational concepts and facilities is presented. This paper presents the basic concepts of a master plan for the creative settlement that is planned to be realized in Russia.

Keywords: Enablign Spaces, creativity, education, entrepreneurship, innovation, urban development, systems innovation.

1 Introduction: an ecology of innovation artifacts

The case study presented in this paper is based on an architectural and innovation project for a small urban settlement of about 20-40 hectares (1.000–2.000 inhabitants), which will be realized approximately 20 kilometers outside of major Russian cities. The goal is to develop a “creative settlement” as a resilient and self-sustaining innovation eco-system which is based on sound scientific research results. It represents an eco-system that is sustainable as it regenerates itself through its social design (people working and living there), as well as its knowledge and innovation processes (education, working/business). It provides an ecology of innovation artifacts (cf. Krippendorff 2006, 2011) with self-regulating the in-, through-, and out-flows of knowledge, people, innovations, discourses, etc.
At first, the client’s brief was to create a role model for a well-balanced integration of living, education, and work. However, during the research and design process, the “creative settlement“ emerged as a place fostering responsibility through people with an entrepreneurial and innovation-driven spirit—a place for people who inherently want to move things forward—with focus on the Russian context.
This project is the result of a cooperation in an transdisciplinary team of (both academic and business) innovation experts, architects, urban planners, cognitive scientists, a sociologist and psychologist, as well as an entrepreneur. As it was the goal to develop a radically new design, the project team itself approached the whole development as an innovation process, which is based on the concept of so called “Enabling-Spaces” (Peschl and Fundneider 2012, 2013)—this approach will be discussed in detail in the following sections.
The first part of this paper discusses the theoretical foundations of the Enabling Space approach and gives an introduction to the design process leading to such multidimensional spaces.

2 Designing enabling spaces

2.1 Enabling spaces

Enabling spaces are spaces that are designed in such a way that they enable and support processes of collaborative knowledge creation and innovation. Enabling spaces try to give an answer to the question: How do we have to design environments that enable processes of bringing forth fundamental innovations and thriving social systems?
It will be shown that we have to apply a rather broad notion of space going far beyond architectural/physical space: several dimensions have to be considered including the social, cognitive, emotional, technological, epistemological, and organizational dimensions and aspects. Hence, in Enabling Spaces these dimensions have to be orchestrated and integrated in a highly interdisciplinary manner in order to support knowledge (creation) processes (see Peschl and Fundneider 2012, 2013 for details).
Space is understood as a container providing a set of (active and passive) constraints that are offering an enabling structure that is integrated with enabling process dynamics; they are allowing knowledge processes to flow and to develop their own dynamics in such a way that (radically) new knowledge may break forth. The challenge is to develop a stable design process integrating these dimensions into a holistic framework or ensemble, which functions as a coherent Enabling Space.

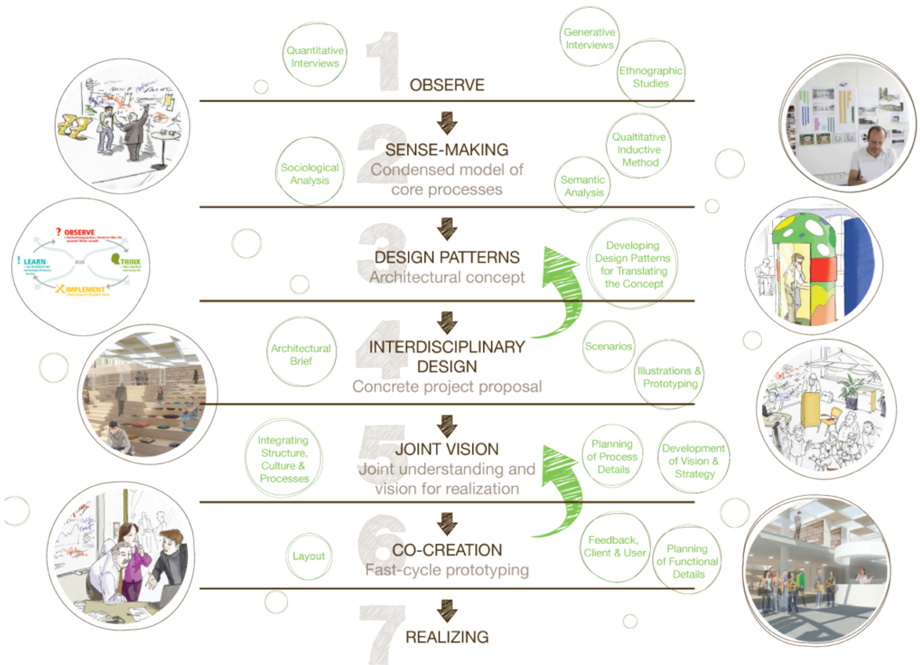

Fig. 1:. The Enabling Space design process

2.2 The Enabling Space design process

The project design of the "creative settlement" follows the Enabling Space design process/approach (see Figure 1): its goal is to devise and develop architectural design concepts for spaces cultivating and supporting processes of knowledge creation and innovation. The integration and orchestration of various space-dimensions having been mentioned above is one of the most challenging problems, yet powerful features of the Enabling Space approach. One has to follow a design process for achieving this integration. The design process being proposed in this section is the result of five years of the authors' interdisciplinary research (in the fields of cognitive science, theory of innovation, epistemology, and innovation spaces) and of a large number of applied projects that have been realized in different industrial and cultural contexts (for examples see Peschl and Fundneider (2012, 2013) and http://www.theLivingCore.com).

This whole design process is based on a profound understanding of the social system under investigation and its systemic environment. Starting with an extensive research phase ("Observation"), the core knowledge and innovation processes of the social system as well as its cultural, organizational, and structural parameters are identified. This is achieved by applying a wide variety of participatory and ethnographic (qualitative and quantitative) observation methods. The experiences and perspectives of a wide variety of stakeholders are studied through qualitative, generative in-depth interviews. Furthermore, the behaviors and desires of potential users are identified by using a comprehensive quantitative online questionnaire. The observation/research phase is completed by ethnographic studies, as well as by observing and studying artifacts, processes, relationships, etc. that can be found in the organization or system.

In the next step, the "sense-making phase", this systemic multi-perspective and multi-stakeholder view is transformed into a so-called "core-process model" illustrating the research findings in a highly condensed manner. In this phase, the observation results are analyzed, described and reflected by identifying patterns, (hidden) assumptions, polarities, discrepancies, and potentials in a complex qualitative inductive process so that a coherent overall profile being based on a profound understanding of the social system can be developed. In this highly challenging inductive process it is necessary to work on big tables and literally/physically move items around, (re-)group and relate them (many methods that are relevant here are part of the design thinking approach [e.g., Brown 2008, 2009;]). These core processes represent the essence of the social system and act as a solid theoretical and conceptual foundation for all subsequent design as well as for decision-making processes.

This abstract model is then transformed into design patterns (Alexander et al. 1977) describing and explicating design qualities: Their aim is to provide the foundation for translating and transforming these abstract core knowledge processes into concepts for concrete (materialized) structures, activities and processes. They are a necessary prerequisite for understanding and realizing the various (architectural, technological, organizational, etc.) dimensions of the Enabling Space. On the basis of these design patterns, a holistic urban design concept is developed in transdisciplinary workshops bringing together experts from different fields, such as architecture, urban design, information and communication technology, landscape planning, etc. The resulting design concept goes far beyond architectural aspects and—in many cases—brings about changes in the social structures, processes, and culture. Architecture transforms social systems and vice versa.

Whenever crucial decisions are to be taken in this process, the client and a steering team are involved in the transparent planning of further steps, thus assuring continuous feedback between decision-makers, the teams of architects, researchers and experts, and possible users.

3 Creative settlement – research phase and overview over insights and results

In the first phase (“Observe”), more than 30 extensive qualitative interviews (generative/appreciative interviews; e.g. Cooperrider, Sorensen, Whitney et al., 2000; Scharmer 2007) with a wide spectrum of relevant stakeholders (entrepreneurs, digital natives, investors, business angels, property developers, etc.) were conducted. An interview lasted for about two hours and aimed at establishing deeper insights into topics of the original client’s briefing (education, creativity/innovation, working, living) in order to develop a profound understanding of possible core processes for the “creative settlement“. Since this project aims at generating a radically new—at that point in time unknown—innovation eco-system, we could not speak with potential “users” as—at that stage—the project was not yet defined. Hence, most of the interviewees could not yet imagine what this settlement would be about; nevertheless, the interviews were conducted in such a way that we tried to listen to the hidden desires and needs of the stakeholders so that we could derive new perspectives from questioning and reflecting their assumptions (partly in a process of co-creation).

On top of these interviews, the authors visited the site several times and conducted ethnographical studies observing and investigating the context, urban setting, cultural issues, etc. (e.g. Kawulich 2005; Laurel 2003; Spradley 1979). Finally, extensive desktop research was carried out: on the Russian context, relevant Russian value systems/terms (e.g., personal power, family, stability, security, etc.), Russian culture and mentality, Russian economy, the political and demographic situation, on specific functions of the settlement (e.g., interactive science museums, alternative education/pedagogical approaches, learning spaces), etc. The interviews plus all of the remaining research has brought about a huge collection of data, information, first insights and ideas, as well as contradictory issues and polarity fields.

Phase 2 of the research process, the phase of “Sense-making”, tried to make sense out of these vast amounts of information from the field. This step aims at identifying patterns, finding implicit orders, achieving an understanding of background/hidden assumptions, etc. within this information in order to come up with the most important and essential processes or activities (“core processes”) defining the “creative settlement“. The result is a highly condensed model of the core processes depicted in Figure 2; it has turned out that children surrounded by family, living and education, as well as an enabling, inspiring, and vibrant working environment were the key processes for this settlement.

Up to this point, one could follow several well known scenarios that address these core processes quite well, for instance, in the form of a special business park, satellite town, or a science city (having some tradition in Russia); however, these solutions are not really innovative and—furthermore—were not in line with the expectations of the client.

4 Guiding principles and design patterns for a sustainable innovative creative settlement

Instead of falling back into or just adapting already existing solutions of urban settlements or business parks the design team developed distinct guiding principles/design patterns that are applied throughout this project. These guiding principles have been developed from so-called “polarities” (apparently contradicting issues that are excellent starting points for new ideas), from the design patterns, from insights from the research phase; they emerged out of the above-mentioned inductive processes and out of rigorously questioning and reflecting on the assumptions that stand behind the interviewees’ statements:

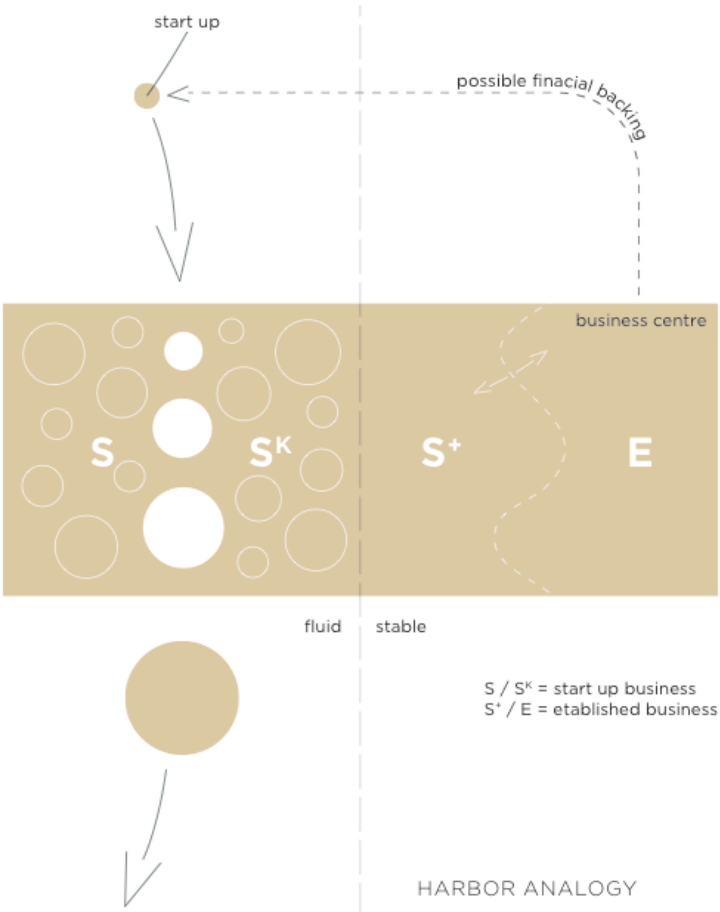

Fig. 2: The Harbour-Analogy illustrating the steady in-, through-, and outflow of new knowledge and people. Start-up businesses (S and SK) dynamically move through the creative settlement in order to bring in fresh and new perspectives. The established business people (S+ and E) are cultivating the stable pole.

(a) Role of creativity, innovation, and entrepreneurship: creativity and innovation are at the core of the creative settlement; they are embedded into entrepreneurial dynamics creating buzz and aiming for a thriving social, knowledge-, and innovation-dynamics.
(b) Openness: is present on various levels and in several domains: knowledge, open-minded people, socially open, open to the public vs. security issues
(c) Balancing the in-, through, and out-flow of new knowledge and people: start-up companies and a so-called established user group (people in strategic positions of bigger companies) are settling and working together in a mutually synergetic cooperation. Figure 2 illustrates the process of renewal (e.g., start-up companies have to leave the creative settlement, once a certain size and economical stability is reached and new start-ups move in).
(d) We are following here a well-known principle from biology, cybernetics, cognitive science, and systems science, namely the principle of autopoiesis: This concept was originally developed by the biologists H.Maturana and F.Varela (1975) for describing the dynamics of living systems: according to the concept of autopoiesis living systems have to be understood as self-sustaining and self-regulating systems, (re-)creating themselves and their borders in a continuous process of transient stabilities (a homeostatic equilibrium) by interacting with, reacting to, and actively acting on their environment. We are applying this principle here to describe the knowledge dynamics and the social dynamics of the “creative

settlement". The goal is to maintain this tension, this "stable instability", this state of homeostasis of inflow of new knowledge and people, assimilating this knowledge, developing it further, getting inspired, creating new knowledge, using and exploiting this new knowledge and, by that, creating new realities, innovations, as well as social structures. The whole system aims at producing a thriving ecosystem of new knowledge, creativity, prospering individuals and a stable social dynamics in accordance with the surrounding environment.

(e) Primacy of incubation: the creative settlement offers protection and at the same time it stays open for new ideas, knowledge, innovations, technologies, etc. (compare also the issue of exploration vs. exploitation (on the scale of a small-sized urban knowledge ecology (e.g., Corso et al. 2009)).

(f) Providing leading-edge education: from créche to academia, education is organically embedded within living and working; furthermore, these educational places are open for people living outside the "creative settlement", such as from surrounding cities and existing villages.

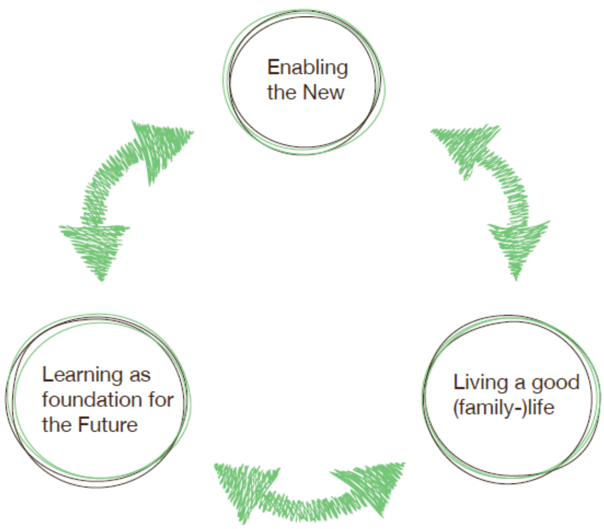

Fig. 3: The core-processes of the creative settlement.

Above these guiding principles various issues had to be solved and integrated in an interdisciplinary manner in the form of an overall process design. Figure 3 shows these core processes that are interacting and mutually causing each other:

(i) "Enabling the New": innovation, spirit of entrepreneurship, start-up dynamics

(ii) "Learning as a foundation for the Future": highest quality and leading edge education on all levels ((pre-)kindergarten, school, entrepreneurial academy, science museum)

(iii) "Living a good (family-)life": good balance between life, family, and work; high quality living environment; providing a safe harbor for living.

All these considerations led to the identification of the user-groups by relating the desired knowledge and innovation processes to potential users, their skills, their business contexts, as well as their needs for living (e.g., family live, good quality houses, education). Examples for such user groups are the start-up founders, people working at the start-ups, established business men (investing in the start-ups), young families living in this creative buzz, etc.

Furthermore, scenarios have been developed that offer quantitative measures concerning balancing of number of users per user groups and balancing the different functions (school, smart working, different residential areas, sport facilities, entertainment, science museum etc.).

5 Realization of the creative settlement

Departing from the above-developed guiding principles and design patterns the architects as well as the social designers started to transform these rather abstract concepts into concrete architectural and social forms (see also Figures 4 and 5); here are the most important realizations:

(a) Communication plaza: this element is a meeting & communication space around a central plaza for residents, business people, as well as the general public. A gradient from public (entrance, restaurants, science museum, etc.) to private areas (living, school, etc.) allows for different levels of privacy and openness. Inside, the plaza reveals the functions of the adjacent elements by opening up the architectural skin, thus becoming public experiences. The communication plaza is defined by the surrounding elements/functions, such as smart working spaces, a science park, an entertainment center, sport facilities, and a school. Thus, the communication plaza acts as a connecting interface, creating a buzz and a vibrant atmosphere just by being there at the intersection of these units and functions.

(b) Open and public educational spaces: open to the public and offering courses, activities, events, etc. on a regular basis. The concept is to provide a high quality educational offer, which goes far beyond classical school offerings or curricula. The authors suggest to view these educational infrastructures in a plug-and-play manner: i.e., to combine a set of the following modules according to the affordances, needs, preferences, etc. of the specific context and the environment of the “creative settlement“: (i) science and technology: newest insights and results from various fields of the natural sciences and technology are presented and collectively experienced, explored, and further developed. The goal is to involve the visitors in the process of doing science and research. One can think also of a science park of jointly creating new knowledge and insights in various settings (workshops, labs, fab-labs, simulations, etc.); (ii) arts and humanities: these modules comprise a wide variety of offerings as well as zones for different fields of arts: painting, sculpture, performing arts, dance, etc. There will be need of specific spaces for these fields of art (ateliers, stages, etc.); (iii) entrepreneurial thinking and innovation: provides state-of-the art approaches in different fields of entrepreneurship and innovation. Both theoretical and practical aspects will be taught. The work being done in these courses and workshops might result in innovations, prototypes, and or co-operations with start-ups in the creative settlement (e.g., internships, etc.); (iv) thinking styles, interdisciplinary thinking, reflection, and personality development: Teaching in this module provides generic skills that are necessary for any kind of knowledge and innovation work and education. This is a unique offer, as these things are normally not taken care of in classical educational systems and curricula.

(c) Focus on balancing user groups and functionalities: in order to establish a fruitful symbiosis (entrepreneurial activities) between the various target groups it is important to keep the ratio of start-up people and established people (individuals in strategic positions of larger companies) well-balanced. Either group dominating would result in a shift of the character of the proposed “creative settlement“—especially a shift towards loosing the creative buzz. Consequently, the design of the “creative settlement“ is focusing on the links and relationships between functions, rather than on single functions. Hence, it is not possible to just remove or add certain elements or functionalities of the “creative settlement”, as this could imply a destructive pertubation of the autopoietic dynamics of the creative settlement.

6 Concluding remarks

It is important to understand that this settlement does not primarily address a romantic view of living and working in the countryside or a kind of “wellness” program for a good work-live balance. Rather, by focussing on the core processes—in this case, knowledge and innovation processes—it is a well-balanced eco-system continuously bringing forth new knowledge, innovations, as well as educated and cultivated individuals and social structures. One has to know that there exists a long tradition of research settlements or science cities in Russia, e.g. Naukograd or Zelenograd—they have a rather positive reputation.

From this perspective, the “creative settlement” is located in a positive distance (accessible but remote) from a major city, this supports the above discussed creative processes and innovation dynamics in a highly efficient manner. Historically, cities emerged around (road) junctions, water routes, etc., since most products and processes were—and still are—based on material structures. In our age, this material foundation of products gets relativized: knowledge processes and knowledge creation are inherently immaterial, they are not bound to roads, but require new epistemological, social, as well as technological eco-systems in which they can thrive: Enabling Spaces.

This leads to a second important issue: the “creative settlement“ is both open and closed: closed, because (radically) new knowledge is highly fragile and needs some kind of a “safe“ container, where this knowledge can be incubated, explored, tested, etc. On the other hand, there has to be a steady stream of new people, knowledge, technology, etc. moving in and out in order to enable the creative settlement to regenerate itself, re-create itself, re-define its borders, etc. (compare the analogy with an autopoietic system). In an analogy the settlement can be thought of as a harbor (see also Figure 2). Ships of young (start-up) entrepreneurs are entering the harbor (inflow of new knowledge, ideas, etc.) and after a period of protection (regarding their fragile ideas), incubation, and exchange (with other entrepreneurs and experienced business people) and when their business models have proven successful or at least promising, they are ready to leave the protected place and sail out across the ocean (entering the business environment). In this sense, the harbor (respectively, the “creative settlement“) is a place to anchor, a place for incubation (protection). However, it is of utmost importance that the ships are not becoming permanent residents of the harbor, since then the flows from the external world will be inhibited.

The project team has translated the concept into concrete architecture and process structures; that process has been finished by the end of June 2012. First visualizations are shown in Figure 4 and can be found under http://www.thelivingcore.com/realized-projects/ and http://sferiqtown.com/. Negotiations with potential investors and political stakeholders in Russia are underway.

Fig. 4: Overview over the creative settlement.

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The system as emergent process in Topos Theory

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Keywords: Emergence; Design; Open System Theory; Open Holistic Systems; Life Systems; Process; Topos Theory; Category Theory; Cartesian Closed Category; Adjointness; Terminal Object; Category of the Ultimate; Quantum Reality; Robert Rosen; Alfred North Whitehead.

1 Overview

Emergence is a fundamental component of the current understanding of science but as a 'top-down' holistic mechanism it would be a contradiction in terms to call it foundational. Emergence describes the global devolution of the world everywhere adjoint to local evolution. Emergence is often as at this EMCSR meeting bracketed with the word 'design'. To grasp a rigorous understanding of these twin terms as part of science they need to be expressed as formal concepts. Systems Theory hardly justifies its existence as a theory if it cannot be expressed formally. Formal definitions are not always easy and particularly difficult when they lie at the cutting edge of science in *terra incognita*. Emergence is usually treated as a process and design as possessing an open structure. Words like 'process' , 'structure', and 'open' more fortunately do have a track record to draw on.

Emergence as allied to design belongs to open system theory. It is the process that comes out of 'openness'. To be scientific systems theory has to be underpinned by rigorous logic. Classical logic tends to be stuck in closed systems and does not avail much for open systems. Yet open systems comprise the vast majority of problems in current areas that system theory is today called to address. The logic of openness is by its very nature the logic of the third way. Such logic is very difficult to represent in classical logic because classical logic is Boolean and only operates two-way. We earlier drew attention to the difficulties even to define 'open systems'[1] let alone to understand them formally. A *cause célèbre* for emergent design is to explain the existence of life. The pioneer a way ahead of his time in the study of life systems was Robert Rosen who recommended a shift from set theory to category theory:

"the natural habitat for discussing . . . specific modelling relations". (Rosen 1991 p 153)

Rosen's informal diagram is reproduced in figure 1. Emergence is in effect the 'implication'[2] on the right of his diagram. We followed Rosen's prescription for category theory to express the logic of social systems[3] . It turns out that Rosen's informal diagram was an early attempt to represent the archetypal process of universal adjointness in a cartesian closed category as shown between any two categories in our corresponding formal diagram of figure 2. This shows the contravariant free and underlying functors between the left and right structures. Given any one of these fixes the other three uniquely when expressed this way. Therefore a particular right structure emerges by a particular choice of the free functor (F). This is both awesome and trivial in that every choice we make determines the next unique state of the world.

[1] See, Heather & Rossiter (2006)

[2] In Rosen's context 'implication' was the emergence of life.

[3] See, Heather & Rossiter (2008)

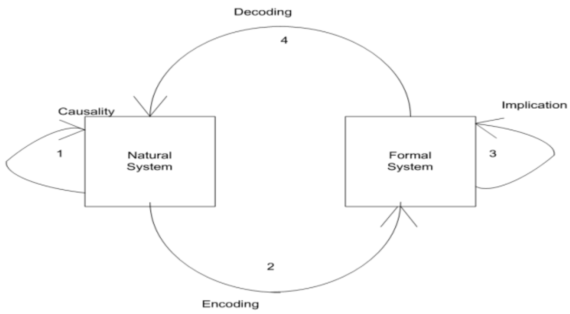

Figure 1 Rosen's Formal Modelling (Rosen 1991 fig 7F.1)

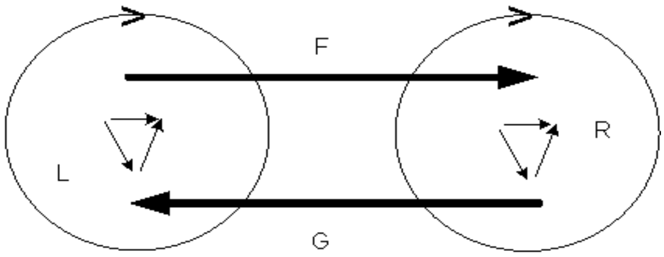

Figure 2: Adjointness between Left Category (L) and Right Category (R) for any left-adjoint free functor (F) and corresponding right adjoint contravariant functor (G)

(Heather & Rossiter 2006 p31)

However as a mathematical model is restricted by the limitations of set theory we have found it necessary to follow Alfred North Whitehead in his seminal work on Process & Reality and ascend up two levels from models to metaphysics4. This brings us to the highest possible level of category theory which is topos theory. The topos like the category is another of Aristotle's insights. From a conventional 'bottom-up' approach this is a terminal object but in the reality of quantum theory it is the starting point. The topos is the formal structure where every entity effects every other entity directly and indirectly through every other object, which describes the structure of the physical Universe. Grothendieke of the anarchic Bourbaki group of mathematicians in France was possibly the first to grasp the concept of the topos as a 'mathematical universe of universes'. However that is one level too short to reach the level of Whitehead's metaphysics. We need to go up to the category of category of categories (the level of the double power set in naive set theory) to reach the top level of closure, the topos as in figure 3. Here there are the three levels of category. The double headed arrow represents the pair of contravariant functors as in figure 2. Also such a pair exists between each level. Consequently the left to right structure of figure 2 represents the process of emergence.

[4] See, Heather & Rossiter (2014).

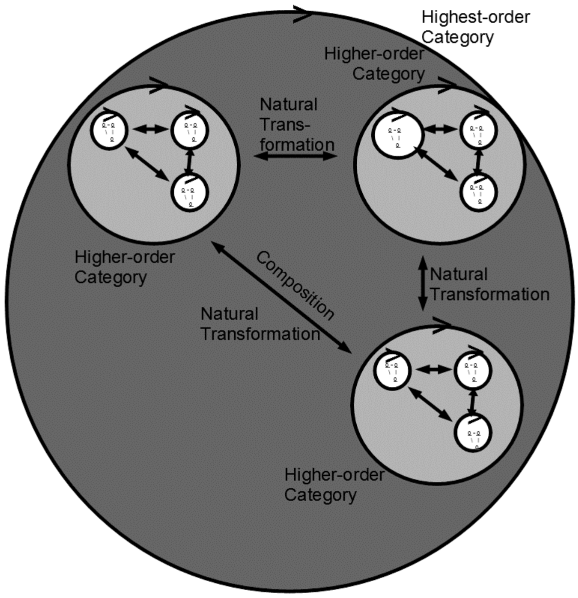

Figure 3 The Topos of Emergence

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Michael Heather and Nick Rossiter have collaborated on over 150 papers in the theory of information systems and related topics, concentrating mainly in the application of category theory.

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II C 1
Bertalanffy and beyond: improving systemics for a better future

Chairs

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Over the last 150 years it has become clear that the world is complex in ways that go beyond the abilities of traditional forms of reductionism to analyse. Systemic approaches clearly represent a major advance on traditional reductionism, but despite enormous progress over the last 40 years the Systemics we have today are not adequate for all our needs. Furthermore, we do not yet have a unified science of complex systems, nor a unified systemic worldview: the contemporary Systems Movement is highly fragmented in terms of outlooks, methods and ambitions. Moreover, the presently available Systemics have been developed via diverse routes from disparate foundations, and we have no unified perspective on how new Systemics are or could be discovered. The challenges encountered today in almost all fields of science and human activity indicate that there is a great need for the development of an overarching framework of understanding and representation which will serve as a guide to, rather than a restriction on, the evolution of thought. The need to establish such a clarifying and fecund framework has now become critically urgent. Contemporary society faces significant existential and developmental challenges, and civilisation may now be at a crossroads where if we cannot act to ensure we are on the road to global thrivability we will almost certainly find ourselves on the road to global extinction. To deal with these challenges we need to develop powerful new Systemics, or at least find ways to radically improve the existing ones. This urgent need applies at all levels, including the technological, the personal, the social, the cultural and the environmental.

List of Contributors

Yagmur Denizhan: Towards a mediation-based engineering
Manfred Drack, David Pouvreau: General system theory and cybernetics: differences and commonalities
KingKong Lin: Consiliencing the holos âˆž model for holos civilizations on a thrivable planet
Oleksandr Makarenko: Towards system analysis and modeling of global sustainable development
David Rousseau: Foundations and a framework for future waves of systemic inquiry
Julie Rousseau: GST as a route to new systemics

Jennifer Wilby: Boulding's social science gravimeter: can hierarchical systems theory contribute to its development?

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Towards a mediation-based engineering

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Abstract: This contribution analyses the problems associated with the basic organisational principle of Systemics and proposes a mediation-based alternative inspired by Gilbert Simondon's Theory of Individuation. Adoption of this principle in the development of new technologies, as well as social and environmental policies can open a path towards a better future.

Keywords: Systemics; organisational principle; individuation; mediation.

The Systems Movement was founded with a vision to rescue science and philosophy from its fragmented state, as well as from the various types of reductionism inherent to the established single disciplines. The approach of describing entities in terms of their mode of existence as a collaborating composition of “lower order entities”, i.e. as systems, indeed seems to provide a modular tool of thinking applicable virtually at any scale and in any domain. In that respect it can be expected to render possible knowledge and technology transfer between hitherto isolated domains of inquiry. In particular, it seems to bear the potential of providing a viable framework for the social sciences and humanities that puts the human (back) into their place within the rest of the Being.

This approach has indeed led to the discovery of fundamental systemic mechanisms and to great achievements in the analysis of complex natural systems, as well as in the development of complex technological systems. But the achievements in social sciences and humanities are relatively few and the aspiration of creating a fair and peaceful social system in harmony with the rest of being is far from being actualised. Also the originally intended unification of knowledge within an overarching framework capable of accommodating the whole span of hard and social sciences is still out of sight.

Actually, both the inefficacy of epistemic unification and the non-uniform distribution of the achievements of the Systemics across different disciplines may share some common causes, the analysis of which may provide an insight into how Systemics could be improved.

1 The two-level organisational principle and its implications

At the basis of Systems Thinking lies the fundamental scheme that relates a set of interacting subsystems (or components) on one hand and the irreducible whole they constitute on the other hand. This two-level scheme which links two successive organisational levels and thus has no reference to any absolute organisational level or domain seems to constitute a ubiquitously applicable organisational principle that promises epistemic unification.

However, this two-level organisational principle actually has a latent reference to a very specific locus within the whole Being, namely that of the human observer, the subject of the act of Systems Thinking. Given the inherent asymmetry of the organisational principle, i.e. the fact that the two levels do not have the same functionality, it is clear that the Systems Thinker is bound to see phenomena at organisational levels below his own level and those at levels above from different perspectives.

Looking at systems at organisational levels below his own level (i.e. in the domains of hard sciences) the Systems Thinker observes a coordinated self-regulating whole and tries to understand which subsystems it entails and how these keep functioning as a whole. If the problem is the creation of such a system, the question turns into determining which ones out of the rich palette of available subsystems and components should be considered and how they may be coordinated such that they constitute a system satisfying the design specifications. Although it is not a must, this approach typically leads to a bottom-up construction method, where the requirements related to lower organisational levels (the existence and availability of specific types of subsystems and components) and those related to higher organisational levels (e.g. social or environmental concerns) are not given the same status. The former are taken for granted as a reality of the technology market, while the latter are typically reduced to some factors within an objective function or to some additional constraints.

On the other hand, when the Systems Thinker is looking at systems at organisational levels at and above his own level (i.e. in the domains of social sciences and humanities) his immediate observation is actually confined to the interactions among subsystems/ components at his own level. Here the task is typically to speculate or to establish the existence of the yet unobservable system at a higher organisational level. While the social and environmental expectations from Systemics rely on the acknowledgement of man's status as a subsystem of higher order systems, policy makers frequently fall a prey to the illusion of residing at the higher level of the two-level organisational principle and try to engineer an organised whole, of which they can actually be only a subsystem. This seems to be a very common scenario responsible for the strong divergence from the aspiration of establishing a fair and peaceful social system in harmony with the rest of Being.

As a matter of fact, humans can best analyse what they create themselves and then utilise this understanding to reason about the rest of Being. As a consequence, paradigms underlying successful technologies of a given era have a strong influence on the general world view and the approaches of social sciences and humanities of that era. Keeping this point in mind, I want to propose a modification in the basic organisational principle of Systemics, hoping that it will not only resolve some of its theoretical problems but also render a different kind of engineering possible that can constitute a basis of analogy useful for social scientists and particularly for policy makers. The suggested modification is inspired by the Theory of Individuation of Gilbert Simondon, a long forgotten yet recently reviving French philosopher.

2. Some Simondonian concepts of individuation

Gilbert Simondon (1924 –1989), unlike many philosophers who have dealt with the problem of individuation, considers the process of individuation as the key concept rather than the individual. I will try to explain some basic concepts using the illustrative example of crystal formation within a supersaturated solution. Let us assume that initially the solution is kept unperturbed within a uniform flask such that no macro-scale reference exists for the molecular process of crystallisation to start from. However, when a single crystal seed is dropped into the solution, the crystallisation process, which organises the molecules according to the specific pattern provided by the seed, starts around it and continues at the interface where the growing crystal meets the not-yet-crystallised solution until finally the whole flask is "conquered" by the crystal.

For Simondon the initially unperturbed supersaturated solution constitutes a ***metastable preindividual domain***, i.e. an unstructured domain in a state of pure potentiality, laden with tensions and ready to unfold and bear new dimensions. The crystal seed provides a macro-scale reference point for the crystallisation to start from and at the same time serves as an ordering principle at molecular level, thus allowing an ***interactive communication between disparate orders of magnitude***. During the growth of the crystal the steadily expanding boundary is the site of this communication. According to Simondon, ***individual*** is this dynamic entity which is ***a node of communication, a mediator*** between disparate orders of magnitude. Another example may be useful for better understanding this kind of mediation. Plants can be considered as an individual that has emerged as a mediator between molecular and cosmic orders of magnitude: while solar energy drives the molecular process of photosynthesis, its output cumulatively contributes to the composition of earth's atmosphere.

Coming back to the crystallisation example and assuming that the temperature remains constant, we see that at the end what is left behind is a macro-scale crystal immersed in what is an exactly saturated solution at that temperature. Simondon considers this crystal not as an individual but an ***individuated being***, an entity deprived of its preindividual metastable potential, thus no more capable of further individuation. In this very simple example of physical individuation under the assumption of constant temperature the process ends up with an apparent exhaustion of metastability, but this is generally not the case. Particularly, in living individuation the metastable potential (and thus the ability of further individuation) is sustained by the process of individuation itself.

It is worth noting that even the simple physical individuation example of crystal growth provides a promising metaphor for viewing systems from a novel perspective: as long as the process continues the dynamic crystal growth zone at the boundary, i.e. the individual, can be considered as an emergent open system.

3 A mediation-based principle of organisation

Let us concentrate on the ontogenetic scheme presented in this individuation process: The individual is an open system that emerges at an intermediate order of magnitude as a ***mediator*** between a lower and a higher order of magnitude. So, unlike the common usage of mediation in Systemics to indicate a hub in a network, in other words a subsystem that facilitates fruitful interaction among other subsystems at the same organisational level, mediation in the Simondonian framework occurs between disparate orders of magnitude, thus typically between different organisational levels, and is connected with the emergence of an intermediate level. It is exactly this ontogenetic principle involving three different orders of magnitude –which can roughly be associated with three different organisational levels-, that I want to propose as an alternative to the classical two-level organisational principle of Systemics.

Such a three-level ontogenetic principle, which I want to name the ***mediation-based principle of organisation***, has various advantages over the two-level principle. First of all it is inherently dynamic and allows the emergence of an intermediate level as a resolution of the conflicts between requirements of disparate orders of magnitude. Scientific explanation of the causality underlying a scenario of complexity increase via emergence of intermediate-level systems seems to be more tractable than that of complexity increase via bottom-up emergence of higher organisational levels.

The mediation-based principle of organisation accounts for the emergence of systems, which are inherently endowed with properties like openness, sustainability, adaptability etc.. Such desirable attributes are inventions of modern Systemics and need to be additionally indicated (or imposed) because they do not necessarily follow from the bottom-up emergence according to the two-level organisational principle.

The mediation-based principle of organisation also has an advantage with regards to the position of the human observer. As mentioned in Section 1, when evaluated on the basis of the two-level organisational principle the whole Being is split into two halves, each of which are necessarily seen from a different angle by the human observer. This constitutes a serious discouragement for the epistemic unification aspired after. The mediation-based principle, on the other hand, places the human observer at the intermediate level between these halves, thus uniting rather than separating them.

Now, let us envisage the engineering implications of the mediation-based principle of organisation. As mentioned in Section 1, the common bottom-up construction approach takes the requirements related to lower organisational levels for granted, while reducing the requirements related to higher organisational levels to some factors within an objective function or to some additional constraints. If, however, we try to develop a new technology by allowing a real or simulated set-up that allows interactive communication between, for example, user-scale local needs on one hand and social and environmental needs on the other hand, then eventually a solution would emerge that mediates between the local and global needs. As a matter of fact, some biologically inspired design methods like Evolutionary Algorithms, typically used in the development of very complex technologies, can be regarded as examples of such a mediation-based engineering. Development, popularisation and systematic usage of mediation-based methods in technological development can contribute to a better future not only by providing more sustainable and environmentally-friendly technologies, but –perhaps more importantly- by creating a system development paradigm that can inspire policy makers for creating a fair and peaceful social order in harmony with the rest of Being.

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General System Theory and Cybernetics: differences and commonalities

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Abstract: General System Theory (GST) and Cybernetics are variously interpreted by different authors. The evaluation of such differing notions calls for looking back in history, specifically at the time of origin of the respective fields. Both fields emerged in the mid-20th century. Their roots and agendas were distinct but overlapping. The two fields were developed parallel to each other by several authors, in both cases inhomogeneously. This yielded widely divergent views. Ludwig von Bertalanffy was the founding father of GST and therefore had a clear understanding of this research program. It is appropriate to examine his understanding of GST and how he related it to Cybernetics. He compared both fields on various levels, including concepts, epistemology and world view. Concepts that are important for both fields are: system, interaction, dynamics, feedback, regulation, and teleology. Bertalanffy was clearly mostly concerned with first order Cybernetics, but his perspectivist epistemology is also relevant when comparing GST to second order Cybernetics. His approach cannot be dismissed as mere “realism”, and he had a clear understanding about what the merits and limits of a model are. An important issue for Bertalanffy was the difference in the world views of GST and Cybernetics. What he definitely rejected was the mere mechanistic or machine view that allegedly prevailed in Cybernetics. Here, we provide an overview of such differences and commonalities between GST and Cybernetics. This will help answer the question whether the arguments from both sides can be sustained. The analysis of such differences and commonalities is not only of historical interest, but also sheds light on today’s controversies especially with respect to epistemology and world view. Knowing the history of arguments is always useful for improving our understanding and promoting progress.

Keywords: Ludwig von Bertalanffy, General System Theory, Cybernetics, Epistemology, World View

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Consiliencing the Holos ∞ model for Holos civilizations on a thrivable planet

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Abstract: The coming decades will not only be a time of great crises, but also a time of great opportunities. For the first time in history tens of millions of people are working for constructive change in some scenarios of edge of chaos. The strengths of this movement to new civilizations are that it is enormous and diverse, organic and self-organizing. Donella Meadows pointed out that the quickest way to transform a social system is to change the dominant paradigm. The paper proposes the Holos ∞ Model which comprise a transdisciplinary interaction of biological, behavioral, sociocultural, and macro-environmental factors could change the dominant paradigm. The Holos ∞ Model explains how holos civilizations toward our thrivable planet beyond sustainability can be wholly designed, simulated, and co-evolved across all the transdisciplinary area today.

Keywords: Holos ∞ Model, post-singularity civilizations, holos civilizations, thrivable planet, transdisciplinary interaction

1 Scenarios of the edge of chaos

The edge of chaos is balancing on the edge between periodic and chaotic behavior, of instability with order. The edge of chaos is characterised by a potential to develop structure over many different scales and is an often found feature of those complex systems whose parts have some freedom to behave independently.

In Oliver Markley's researchs(2011a, 2011b, 2011c, 2012), he based on the "Aspirational Futures Method" pioneered by Clem Bezold about Expected (PTE), Challenging (fearful), Aspirational (hopeful), and Audiciously aspirational (visionary) to described five scenarios of the edge of chaos:

- VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) - an "Expected" or Present Trends Expected (PTE) future.
- Civilizational Disintegration - a "Challenging" or worst case future.
- Reformative Civilizational Recovery - An "Aspirational" (Visionary) future.
- Civilizational Enlightenment - An "Audaciously Aspirational" future.
- Singularity – A second "Audaciously Aspirational" future.

Dependent on the Oliver Markley's five scenarios of Alternative Mega-Crisis Possibilities, the author drawn a diagram "Scenarios of the Edge of Chaos" (Figure 1) according to the diagrams from Richard Foster(1986), John P. Van Gigch (1991), Joel A. Barker(1992), Charles Handy(1994), Ian Morrison(1996), Ervin Laszlo(2001, 2006, 2008, 2010), David Korten (2006), Duncan M. Taylor & Graeme M. Taylor (2007a, 2007b), Oliver Markley (2011a, 2011b, 2011c, 2012).

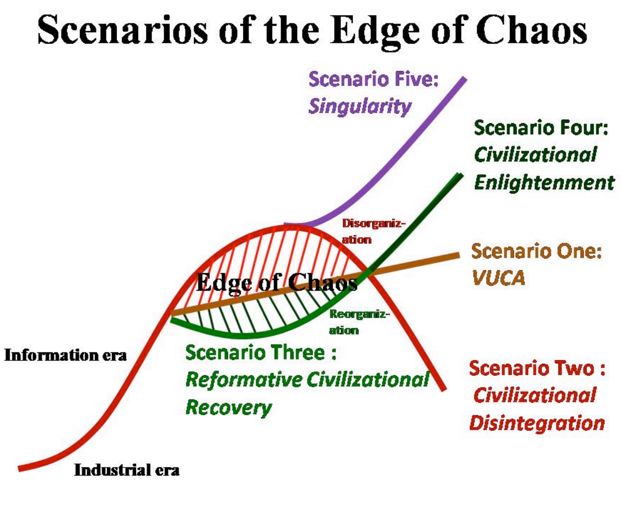

Figure 1. Scenarios of the edge of chaos

2 From Logos Civilizations to Post-Singularity Civilizations plus Holos Civilizations

In 1960, Alastair Taylor developed his systems theory model of the historical evolution of human societies, which he designated Time-Space-Technics (TST). TST identifies an evolutionary sequence of world-views that organize societal systems at the different levels and applies evolutionary systems theory to the historical development of human societies. Since these developmental stages/Ages are organized by their worldviews, Taylor called them Mythos I (the animistic world of hunter-gatherer societies); Mythos II (the ancestor-worshiping world of herder-cultivator societies); Theos (the theocratic world of agrarian civilizations); Logos (the rationalist world of industrial civilizations); and Holos (the holistic world of the emerging planetary civilization). In his last life, Taylor believed that modern era stands at a critical point: although industrial society has become globally unsustainable, we have the chance to redo it with new values to a sustainable global civilization.

Those issues challenge humanity to avoid societal and environmental structure suddenly fall down. In contrast, visionary expectations can attain a new level of planetary hope, with its unique world-view.(Taylor, 1999) . Laszlo(2001, 2006, 2008, 2010) followed his pace and proclaimed two civilizations in front of us: one is Logos civilizations and another is Holos civilizations.

The idea of the post-singularity civilizations was first popularized by legendary futurist Ray Kurzweil in “The Singularity is Near: When Humans Transcend Biology”. After mastering the methods of technology and biology, Kurzweil(2005) predicts that human/machine civilization will expand its frontiers into the universe, gradually (or perhaps explosively) consuming the contents of the cosmos until the universe reaches a ”saturated” state where all inanimate matter has been converted to substrates for computation and intelligence, and a truly universal super-intelligence takes form.

In The Fourth Wave: A Normative Forecast for the Future of SpaceShip Earth, Markley (1995) idealized alternative futures following an epochal transition. He showed us the Epochal tipping point is 2022 +- 8 years. The global system of modern civilization is now economically, socially and environmentally unsustainable. It is based on dangerous views and values that raise competition, exploitation, inequality, threat, harm, and pain. If the modern industrial system with its expanding consumer culture continues to deteriorate the living world, growing economic, social, environmental crises will inevitably self-destroy modern civilizations as we know it. Computer modeling indicates that this trend will cause environmental and economic collapse by 2050 (Meadows et al., 2004; Randers, 2012; Turner, 2008)

By integrating the ideas of an epochal transition and the five scenarios of edge of chaos, the author drawn a diagram “From Logos Civilizations to Post-Singularity civilizations plus Holos civilizations”(Figure 2) to describe some future civilizations mentioned above.

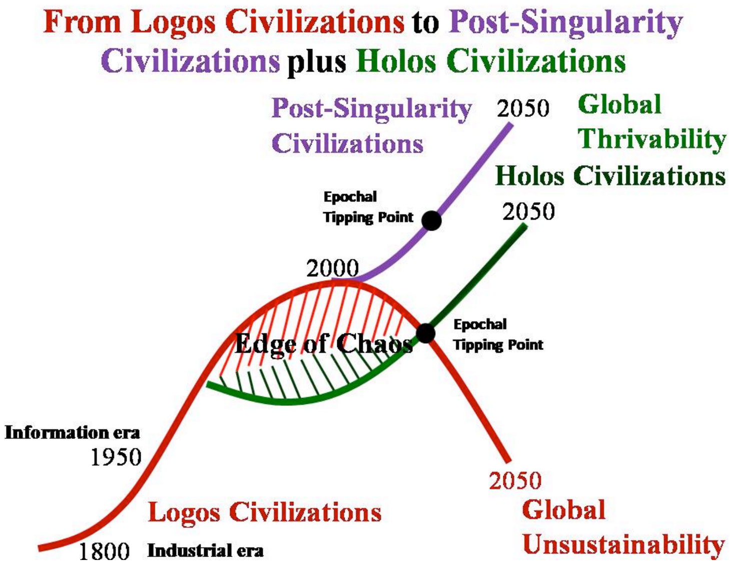

Figure 2. From Logos Civilizations to Post-Singularity Civilizations plus Holos Civilizations

In the bifurcation point, the breakthrough path is named resilience, so the path from Logos Civilizations to Post-Singularity Civilizations plus Holos Civilizations may be called "Resilience" too. Resilience is the ability of a system to return to its initial state after a disturbance. The characteristics of resilience are more effective use of information, greater free-energy efficiency, greater flexibility and creativity, and higher organization levels(Laszlo, 2001). The emerging outcomes of resilience are thrivable values, theories, technologies and social organizations, as seventy authors submitted their perspectives on the intend, values, envision, and actions that comprise "Thrivability" in early 2010.

3 Consiliencing the Holos ∞ Model

The way of Post-Singularity Civilizations plus Holos Civilizations is named "consilience" by author. In the academic world, "consilience" literally a jumping together of knowledge by the linking of facts and fact-based theory across disciplines to create a common groundwork for explanation, refers to the creation of a new field of study that combines the world of humanities with Natural Science. Consilience is said to be the foundation of every facet of human life.

As Kenneth Boulding (1956) pointed out, general system theory (and systems science in general) "aims to provide a framework or structure on which to hang the flesh and blood of particular disciplines and particular subject matters in an orderly and coherent corpus of knowledge." The multi-method proposed by systems science is to model complex entities created by the multiple interactions of components and structures by concentrating on the dynamic synergy that are internal or external to the system. The Holos ∞ Model the author created(Figure 3) consilienced major models of systemic thought, such as general systems, cybernetics, physical sciences, mathematics, computers & informatics, biology & medicine, symbolic systems, social systems, ecology, philosophy, systems analysis, and engineering. In regard to applications in typology of meaning systems for transdisciplinary interaction, the Holos ∞ Model can model complex intrapersonal, interpersonal, intergroup, and human/nature interactions between the humanities, the social and the natural sciences. It puts focus on the emergence of transdisciplinary paradigm in different disciplinary interpretations of reality and consequently provides a platform for the integrated meta-model of complexity in the human experience.

Figure 3:The Holos ∞ Model

4 Conclusion

The coming decades will not only be a time of great crises, but also a time of great opportunities. For the first time in history tens of millions of people are working for constructive change. The strengths of this movement are that it is enormous and diverse, organic and self-organizing (Hawken, 2007). Donella Meadows pointed out that the quickest way to transform a social system is to change the dominant paradigm (Meadows, 1997).
The paper proposes the Holos ∞ Model, which comprise a transdisciplinary interaction of biological, behavioral, sociocultural, and macro-environmental factors could change the dominant paradigm. The Holos ∞ Model explains how holos civilizations toward our thrivable planet beyond sustainability can be wholly designed, simulated, and co-evolved across all the transdisciplinary area today.

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Towards system analysis and modeling of global sustainable development

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Abstract: The general questions of sustainable development - the conception, examples and limitations of implementation are considered. General principles for formalization of notion of sustainable development are discussed that may provide the possibility of introduction of strict definitions of sustainable development. General problem of sustainable development is considered from the point of views of weak and strong anticipatory systems. Different models are considered for study of sustainable development. The consideration of mental aspects comes into question at introduction of sustainable development as one of main problems of transformations.

Keywords: sustainable development, system analysis, anticipation aspects, concepts, models

Sustainable development concept is one of general recent problems which have great theoretical and practical importance. Many definitions of SD exist. The definition by Bruntland's Commission (1987) is most recognized and usable. But this definition is verbal. So for computer modeling or quantitative decision –making on SD further development and formalization of the concept are necessary. Because of such needs we propose the formal definition of sustainable development which is useful for SD concept development and applications. Also we describe the role which anticipation plays in sustainable development, especially strong anticipation. Finally the new prospects for proposed ideas for SD are described.

The concept of sustainable development has a long history of its essential components. But the experience since 1992 had followed to necessity of further improvement in concepts. First of all the main accepted definition of sustainable development is verbal and conventional. A little number of quantitative approach exist (system dynamics and some models for modeling large- scales processes, multi- agent approach), indexes of SD. The leak of full operational models follows to the shortage of sustainable development indexes which used for practical planning. So below we propose as the formalization of SD concept as the presumable applications of such formalization, including specific issues.

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs." - following G.H.Bruntland Commission (1987).

That is the discrepancy between the natural resources and between determined by economics and history way of their exploitation exists. The description of sustainable development above have been used as in global theoretical considerations as in local/regional administrative management. However formalization of the original concept is necessary, especially for the goal of quantitative methods applications: modeling, forecasting, measuring of the progress of SD etc. Below we will pose such an useful formal definition of SD.

Here we pose the list of some factors of SD which should be represented in the definition of the concept: representations of parameters in SD processes; existing of dangerous trajectories of system in case of fatal restrictions of resources; possibilities of sustainable trajectories; possible change of leading resources. So, the necessary components for SD are: resources; restrictions on resources; evolutionary aspects; goal of the system; existing of many generations; indexes of sustainability; decision – making processes; mental properties of peoples and cultural aspects; environmental influence; technologies (recent and future).

Parameters and structures in SD (list of issues). Therefore in this section we make an effort to give some primary considering for formalization of the SD concept. At first we will indicate structures and notions which we should take into account in a problem on local SD.

1. We designate the parameters of the system and their description (external, internal, control etc.) as the set of parameters {Par}. In this subsection we will not consider the details of property of these parameters (and elements of description the following), and only will make an effort to select, what structures should be considered. So, for example, we without the special necessity will not consider possible metrical and topology structures, ordering relations, symmetries and others on the set of parameters {Par}, Equations which describe the systems and processes {Equat}, Set of trajectories of the systems {Traj}, Limitations on trajectories and parameters of the system – set {Ω} and set of boundaries of limitations {∂Ω},

Set of criteria of sustainability {SCrit} or the SD criteria {SDCrit}, Set of external control parameters {Contr}, Set which represents the age structure of population on an interval of time [0, T] ({Age[0, T]}), if the interval of time is not indicated obviously, we will write {Age}, Set of initial conditions {Init}, Set which represents the structure of the system {StSys}, the structure of processes {StProc} and the structure of individuals {StInd}, Additional requirements on the components (desirable) – additional to obligatory limitations {Ω} and {∂Ω}. We will designate them as {Aux}, Descriptions rules for decision-making. We will designate those as {Decis}, Set of non-definiteness (uncertainties) in the system {NonDef}.
We will describe now formally, what does it mean SD concept.
Definition of the SD problem. To find the objects from {Init}, {St = {StSys} ® {StProc} ® {StInd}}, {Contr}, {Decis}, such, that as a result the trajectory of evolution of the system turns out tr € {Traj}, that is executed <tr, Cr>t € {SDCrit} ® {Aux} , where <tr, Cr>t means the calculation of value of the SD criterion in a moment t on a trajectory tr, thus the results of calculation must at every instant of time belong to {SDCrit} and to {Aux}. (The symbol ® means the belonging of parameters to all remarked sets).
Associative memory approach to large socio- technical systems had been proposed earlier (Makarenko, 2003), which is useful for SD considering. Initial structures in description are 'patterns'. The 'pattern' is the collection of elements and bonds between them at any moment of time. Such description (patterns) is useful as for environment as for the mental structures of individuals (or agents in the models). Such 'geometrical' description may be transformed in pure 'logical' or sometimes 'linguistic' description. Anticipatory property for social systems and scenarios had been introduced (D.Dubois, 1998). We proposed the application of weak and strong anticipation in SD problems. In proposed presentation we can propose the next illustrations of SD processes on simple examples: One-dimensional illustration for two attractors case. Two-dimensional illustration for two attractors case. Attracting with restrictions accounting. Transitions between attractors with restrictions.
All such issues are useful for considering all kinds of sustainable development. The problem of sustainable development in our approach looks like the problems of the evolution of the system in the terms of attractors, and the transitions from one attractor to other. For understanding and managing of sustainable development the use of the concept of 'landscape' may be helpful. In such a case, the state of the system evolves on the 'landscape' to the nearest local minimum of the functional which corresponds to the 'landscape' (the pictures will be proposed at presentation). Sustainable and non-sustainable ways correspond to different minimum if the bonds between elements are constant and internal patterns of elements are fixed.
Conclusions. In this talk we describe an approach to modeling social systems and decision–making process in them which can be useful for studying the sustainable development with government and government sustainable development. Also some frames for formalizing SD processes are proposed. The approach is based on the models, which have the properties of associative memory and which allow to incorporate the mental peculiarity of involved individuals. One such property – anticipation leads to the existence of multi-valued solutions (which correspond to the scenarios of system evolution). Even qualitative consideration of such property allows understanding of some aspects of decision–making processes, development of government and its impact on society.

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Foundations and a framework for future waves of systemic inquiry

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Abstract: The early general systemists had a "research agenda" for building a 'better world', which hinged on the development of a General Systems Theory that would support transdisciplinarity, aid new scientific discoveries, and build bridges across disciplinary divides without devaluing what is essential to each. Progress against this agenda has been slow, but I will briefly present recent developments that open up ways for executing the "General Systems Research Agenda" in an effective way. In more detail I will present a principled framework indicating that the three 'waves' of systems enquiry we have had to date ('hard', 'soft' and 'critical' systems thinking and practice) are the first in a series of (potentially) seven, discuss the prospects for generating the further waves, and show how they are essential for systemically creating a 'better world'.

Keywords: von Bertalanffy, systems philosophy, moderate realism, systemic semantics, GST, Midgley Waves

"The contribution of the systems view to humankind's betterment depends crucially on which systems are singled out for scrutiny and from what perspectives" (Rapoport, 1973, p. 190).

1. Introduction

If we are to build a flourishing future we have to:

- find effective ways to cooperate and communicate across disciplines,
- integrate and expand our knowledge base, and
- seal the rift between the sciences and the humanities in a way that preserves what is essential to each.

This "research agenda" was already put forward 60 years ago by the 'Bertalanffy circle' as central objectives for the (General) Systems Movement. The main figures in the 'Bertalanffy circle' were Ludwig von Bertalanffy, Anatol Rapoport, and Kenneth Boulding, and the 'school of thought' they represented was later on actively promoted and expanded by *inter alia* Ervin Laszlo, George Klir and Mario Bunge.

The early general systemists thought that the systemicity of the world validates the logic of this research agenda and would make it technically feasible. In particular they thought that the development of General Systems Theory (GST) would be crucial in this effort, providing a framework for the 'gestalt' behind the specialised knowledge of the particular disciplines. However, they had no clear practical ideas about how to pursue this "General Systems Research Agenda" (GSRA) (Pouvreau & Drack, 2007, p. 332; Pouvreau, 2013, p. 859), and little progress has been made so far (Francois, 2007; Hammond, 2005; Wilby, 2011, p. 438,441, 2012, p. 464).

However, this lack of progress is ultimately due to unfavourable historical circumstances, and not to essential inadequacies in their proposals (Pouvreau, 2013, p. 864). Their agenda was well conceived, and based on a sound philosophical framework, which is largely due to von Bertalanffy (see, e.g., von Bertalanffy, 1955). This philosophical framework is not widely known by modern systemists, but is proving crucial for the progress we are now able to make, as I will briefly indicate below and will expand on in my presentation.

I think it is now possible to find effective ways to execute the General Systems Research Agenda, partly because we have the benefit of hindsight, but largely because of the progress the systems movement has made to date and because of wider subsequent developments in academia.

2. Overview

In my presentation I will outline what I see as the key tasks facing such a programme. Projects to address these tasks are currently under way in my research centre (The Centre for Systems Philosophy), working in collaboration with others. I will present insights from this work that have opened the way towards the execution of the GSRA, and discuss some of the implications of these insights for the systems view of the world (more details are given below).

The progress made so far by the systems movement toward developing systemic theories and methods have been characterised by Gerald Midgley as presenting three "waves" of systemic enquiry, each relating to a particular focus of the systems field resulting in the discovery and development of a new set of insights and methods. Midgley called these the 'hard', soft' and 'critical' waves of systemic enquiry (Midgley, 2001, pp. 187–211). I think this characterisation in terms of 'waves' is a helpful one, and based on the work of the abovementioned projects we can now suggest a principled framework for producing further waves of systemic inquiry, and show how they progressively advance our capacity to build a flourishing world. The main focus of my presentation will be:

- the presentation of this framework,
- the defence of the principles behind it,
- a characterisation of four further "Midgley Waves" we can now foresee, and
- a discussion of work already underway or still to be initiated to get these waves fully mobilized.

(more details are given below).

3. Important distinctions

In order to execute projects in line with the GSRA, a number of basic conceptual confusions have first to be cleared up. Three are particularly important:

1. **The scope of GST**: GST is sometimes presented as an objective formal meta-theory over the specialised disciplinary theories (e.g. Boulding, 1956; Laszlo, 1972; Von Bertalanffy, 1956), and sometimes as a portmanteau term for the (evolving) collection of concepts, theories and approaches employed by the Systems Movement (Hammond, 2003, pp. 252–255). To avoid confusion, we recommend using GST in the "narrow" sense of designating a meta-theory over the specialised ones, and "Systems Science" for the "broad" discipline grounded in the systems paradigm and having (narrow) GST as a core component. Systems Science so understood then embraces all the Systemics, including those that are evolving separately from the general systems tradition, such as cybernetics, systems engineering, and systems analysis.

2. **The kinds of the Systemics**: Many systemic theories existed already in the 1950s, and von Bertalanffy considered GST to be "a central member of this group" (von Bertalanffy, 1956, p. 8) without making the distinction principled. In hindsight we can now recognize that these *other* theories (usefully referred to collectively using Bunge's term "Systemics" (Bunge, 1979, p. 1), are of three kinds, namely
   - *Theoretical Systemics*, being theories that model in a formal way specific aspects of natural kinds of concrete systems e.g. fractal theory, cybernetics, chaos theory, automata theory;
   - *Technical Systemics*, which are methods for applying systemic theories in particular contexts on the basis of an underlying systemic theory e.g. VSM, AI, Dynamic Systems Design.
   - *Heuristic Systemics*, which are methods for dealing with specific classes of problems from a systems perspective, but without having an underlying systemic theory, e.g. SSM, CSH, SI.

3. **The relationship of GST to the Systemics**: Granted the distinctions just made, it can be seen that GST is a meta-theory over the *Theoretical Systemics*.

4. Key projects for a revival of the General Systems Research Agenda

Within the Centre for Systems Philosophy we have identified what we see as the key tasks required for executing the GSRA, and initiated projects to address each one, as discussed below. We have made sufficient progress to be optimistic about their feasibility, although it is clear that to execute the projects fully will require much bigger projects than the modest ones we are able to muster with present resources. I will here list these projects and briefly indicate the nature of the new insights that ground our optimism, and then discuss these insights more substantially in my presentation. My talk will focus largely on the last (fifth) one of these projects; the others will be dealt with very briefly for the essential context and support they provide.

4.1. Philosophical Foundations for a GSRA

It is important to carefully identify, review and validate the philosophical presumptions behind the GSRA, and from that base to extrapolate the implications these tenets collectively carry *as a system*. An important reference for such a project is (von Bertalanffy, 1955), and an important overview of the philosophical tenets is given in (Hofkirchner & Schafranek, 2011). Ervin Laszlo gives a simplified systemic account in (Laszlo, 1972), but a detailed analysis remains to be worked out. These philosophical tenets reflect a range of moderate realistic positions, including moderate realism about

- the existence of an objectively real concrete reality,
- the objective existence of concrete systems,
- our ability to acquire objectively valid knowledge via science and evolutionary adaptations, and
- the objectivity of certain values.

Important for present purposes is to note that although many of the tenets of this philosophical framework were controversial already in the 1950s and have become more so subsequently, there is now an emergent convergence of multiple lines of historical and new findings in science, sociology and philosophy, which together suggest that the early “General Systems Philosophical Framework” (GSPF) is broadly correct, and hence carries the implications the Bertalanffy circle inferred for the existence of a GST and the implications of its existence in turn (D. Rousseau, in prep,a)

3.2. A discourse domain for general systems research

From early on there was an ambition to create, from the isomorphies encapsulated in the Systemics and GST, an overarching transdisciplinary language that would facilitate communication and cooperation, but so far this progress has been meagre. On a reconsideration of the implications of GST in the light of the GSPF we realised that this has to be done “bottom up” and systemically, rather than top down and piecemeal. The former of these insights were especially inspired by Laszlo (1972), and the latter especially by Bunge (Bunge, 1977, 1979, 2010). We have developed a framework for doing this work based on more recent ideas from syntactic semantics (Pagin & Westerståhl, 2010a, 2010b; Rapaport, 2002), and learnings from how semiotics can be grounded in Metasystem Transition Theory (Denizan & Karatay, 2007, pp. 173–184). We call this approach

"Systemic Semantics". Limited discussions of it were presented in (D. Rousseau, 2013a, 2013b), and a fuller treatment is in work (D. Rousseau, in prep,b).

3.3. GST as a source of new Systemics

If we had a discipline worthy of the name "Systems Science" it would include principles and methods from which we could discover new kinds of systems *in principle*, giving us new eyes with which to look at nature, and make discoveries on the basis of which new kinds of Systemics will be established. At present we have nothing like this, and such Theoretical Systemics as we do have are discovered 'bottom up' from within the specialized disciplines.

Boulding's classic paper on GST as "the skeleton of science" (Boulding, 1956) suggested that GST would provide such a framework, much as the periodic table did for chemistry and DNA-theory for biology. However, until recently it was radically obscure how to go about constructing the 'gestalt' of GST in a systematic way, rather than obtaining it as an accidental byproduct of the "bottom up" discovery of fundamental concrete facts. Recently, however, Julie Rousseau realised that Boulding's paper embeds a range of conceptual confusions, and if these are cleared up a practical way forward can be found (J. Rousseau, 2014). She will be presenting some of these findings in this Symposium.

3.4. Systemic methods for fundamental research

If the systemic nature of the world implies that the "two cultures" can be united in a way that preserves what is of fundamental value in each, and that exact scientific models can be developed in the fields that currently lack them (without devaluing them in the process), then we must find a systematic way of discovering knowledge beyond the current boundaries of science, and use these methods to look for new kinds of substances, relationships, events, change mechanisms, systemic effects, systemic principles, etc. We need to discover radically new kinds of such particulars, ones that allow us to think in ways beyond current scientific conceptions. Such discoveries will be essential for building non-devaluative models about the nature of phenomena such as consciousness, intentionality and agency. This work is a "bottom up" empirical counterpart to the "top-down" GST project mentioned above.

By following up on Ervin Laszlo's analysis of the implications of GST in the light of the GSPF (Laszlo, 1972), we have been able to make significant progress with the development of such a systemic methodology (D. Rousseau, 2013b), and exploratory use of it has produced results suggesting that it will be important for opening new waves of systemic enquiry (D. Rousseau & Rousseau, 2012; D. Rousseau, 2011a, 2011b)

3.5. Framework for future waves of systemic inquiry

Although the general systems movement has always been motivated by the ambition to work towards a 'better world', there has never been a principled set of criteria for what is meant by 'better', and hence criteria that could be used to prioritise research effort and guide the focus of our inquiries.

However, reflection on this question in the light of implications of the philosophical tenets underpinning the GSRA has enabled us to identify a principled framework for such prioritization and focus. Although we do not have objective theoretical criteria for the idea of a 'better world', von Bertalanffy suggested that intuitive considerations can have objective credibility as a starting point for theory building - because evolutionary adaptations result in our intuitions, instincts and mental categories fitting us to the nature of the real world we have to survive in (von Bertalanffy, 1955). This argument, from what is now called 'evolutionary epistemology', allows us to construct a framework consistent with a wide range of 'betterment' views from many perspectives, e.g. the humanistic psychology of Abraham Maslow and international law frameworks such as the United Nations' *Universal Declaration of Human Rights*. The pattern that emerges from this framework suggests that the three waves Midgley identified are the first three in a series of (potentially) seven, and indicates the scope and focus of the coming four. In my presentation I will give an outline of this pattern and discuss the prospects for bringing about the next four waves of systems inquiry, and discuss their importance for building a better world systemically. It is evident from the pattern of waves indicated by this framework that this work will build a better world in a way that has the potential to seal the rift between the sciences and the humanities, as well as put us on the road to a flourishing eco-civilisation.

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His academic education spans Engineering (with a specialisation in Systems Practice), Philosophy (with a specialisation in Philosophy of Mind) and Religious Studies (with a specialisation in spiritual experiences). His early career involved more than 20 years in senior management, programme management and systems engineering roles in the aerospace and semiconductor industries. Over that period he maintained a long-standing interest in the Big Questions, and the clues about them provided by exceptional human experiences. Over time he realised how systems thinking can open up new lines of research in this area, so in 2008 he started a PhD study using Systems Philosophy to analyse the mind-body relationship in the light of near-death experiences. The success of this research encouraged him to found the Centre for Systems Philosophy to further develop Systems Philosophy and to promote its application. David's current research is focused on the unity of knowledge, the modelling of the nature of Nature, and the ontological foundations of moral intuitions.

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GST as a route to new systemics

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Abstract: The early systemists proposed the existence of a General Systems Theory, by which they meant a theory encapsulating the general organisational principles of the concrete world. Although they inferred the existence of such a theory, they had very limited ideas about how to approach finding it. Subsequent researchers have focussed on bottom-up approaches, such as constructing a GST from isomorphies across concrete theories, but so far without significant success. In my presentation, I will argue for a top-down approach closer to that proposed by Boulding in his famous "Skeleton" paper. I submit that Boulding had a crucial insight for how to make this possible, but due a lack of clarity in his presentation and historical limitations on his knowledge, he produced a confusing account that misled and constrained subsequent efforts to realise his vision. I will show where and how Boulding ran into difficulties, and argue that with the benefit of hindsight and contemporary knowledge we can find the way forward that he envisaged. The key is to analyse how he worked and what he tried to do, rather than just summarizing and recasting what he said in describing the framework at the heart of GST. Preliminary work on this renewed approach suggests that the framework will enable the discovery and application of exact and scientific systemic models in areas where today we have very few, such as the Social Sciences and the Humanities. Given the challenges facing our civilization, it may be of crucial importance to be able to make such progress in these areas.

Keywords: GST, systems, Systemics, Boulding, Bertalanffy, skeleton of science.

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1 Introduction

In the late 1940s and 50s Ludwig von Bertalanffy and the other early systemists proposed the existence of General Systems Theory (GST), meaning a theory encapsulating the general organisational principles of the empirical world (Boulding, 1956, p. 197). They thought that GST could be used to facilitate communication between disciplines, help discover adequate models in fields that lack them, and above all provide a means to bridge the gap between the physical sciences, social sciences and the humanities in a non-reductive way. This was a clear ambition relative to an urgent need, but little progress has been made so far with establishing the envisioned GST.

Several factors contributed to this lack of progress. The early systemists were not able to present a clear explanation of what a GST would look like (Hofkirchner & Schafranek, 2011, p. 178), and they had very limited ideas about how to actually develop it (Pouvreau & Drack, 2007, p. 332; Pouvreau, 2013, p. 859). Equally, they were unable to say anything convincing about how GST would bring science to bear on areas where it traditionally had little to say, such as the study of the nature of subjectivity, values and meanings (Pouvreau & Drack, 2007, p. 332).

However, despite these technical shortcomings and the historical lack of progress I believe that the early general systemists' vision was (and is) credible, and that the subsequent lack of progress was largely due to limitations of context and period rather than deep-seated confusions or wishful thinking. From our present position I think a close reading of the classic works (e.g. von Bertalanffy, 1955; Boulding, 1956; E. Laszlo, 1972), together with the benefits of hindsight and modern knowledge, reveals opportunities for clearing up many issues that were easily confused back then, filling gaps they could not see how to fill, and discovering ways forward that were obscure to them. On this basis I think we can now develop practical strategies for building the GST they foresaw, and put the goals they saw it as facilitating within our reach at last.

2 Scope of my presentation

In my presentation I will explore one such opportunity, presented by Kenneth Boulding's classic paper "General Systems Theory – The Skeleton of Science" (1956) (hereafter, "Skeleton"). This paper is regarded as a sort of manifesto for the systems movement (Richardson, 2004), and yet its practical impact has been negligible. However, my analysis of it reveals that it is a work of great vision and value, although it embeds many confusions and lacunae that have thwarted later efforts to build on it. I will outline the nature of these shortcomings, show how to clear them up, and indicate how that sets us up for a project to develop GST in the systematic way Boulding envisioned.

3 The challenge and promise of GST

3.1 The existence of a GST

When von Bertalanffy and the other early systemists (Boulding, Rapoport, and later on Laszlo) originally proposed and discussed the existence of a General Systems Theory, they meant a theory encapsulating the general organisational principles of the concrete world (E. Laszlo, 1975, p. 16; Von Bertalanffy, 1956, p. 38). They had, from the perspective of their different disciplines, each noticed isomorphies between systemic behaviours in their own disciplines and that of others (A. Laszlo & Krippner, 1998, p. 49; Von Bertalanffy, 1956, pp. 38–39)). With an instinctive realist perspective[1], they inferred that these isomorphies were not accidentally true, but reflected some general order in the nature of the world (von Bertalanffy, 1968, pp. 35–36).

Although they inferred the existence of such a theory, they did not have very clear ideas about how to approach finding it and delivering on its presumed promise. The most impressive early attempt at describing what a GST would be like, how it might be discovered, and the value that it would have, is Boulding's "Skeleton".

3.2 GST as a possible source of new or improved Systemics

In this work I will use the term "Systemics" to refer only to abstract *theories* that model some systemic aspect of some general class of concrete system (e.g. control theory, fractal theory), and exclude from this use systemic *methods* (whether these are based in theoretical Systemics or not) (e.g. SSM, CSH).

The Bertalanffy-era systemists viewed GST as a meta-theory over the specific theories of the specialized disciplines (Boulding, 1956, p. 197,200; E. Laszlo, 1972, p. 21), and hence thought it would be useful for facilitating new discoveries or model-building in the specialized disciplines. However, as we now know, the *Systemics* are already meta-theories over the specialized disciplines, and GST may equally be regarded as a meta-theory over the Systemics, as discussed in (D. Rousseau, 2014). The implication is that GST could provide a route to discovering new Systemics or improving the models within existing ones, thereby opening additional routes for those *Systemics* to make new discoveries or better models within the concrete disciplines.

3.3 Boulding's proposals for possible routes to a GST

In "Skeleton" Boulding outlined two possible strategies for creating a GST:

> *At a low level of ambition but with a high degree of confidence [GST] aims to point out similarities in the theoretical constructions of different disciplines, where these exist, and to develop theoretical models having applicability to at least two different fields of study. At a higher level of ambition, but with perhaps a lower degree of confidence it hopes to develop something like a "spectrum" of theories—a system of systems which*

[1] Although their realism was largely intuitive, and realism has been a controversial position in academia both then and since, recent developments suggest that their form of realism was credible and is gaining increasing support (D. Rousseau, in prep,).

> *may perform the function of a "gestalt" in theoretical construction (Boulding, 1956, p. 198).*

The first approach is bottom-up, starting with observations of isomorphies between concrete disciplinary theories, and abstracting those into general theories. Most research aimed at developing GST arguably followed this approach (e.g. Troncale, 1985, 2009). To date, however, the number of isomorphies identified is insufficient to construct a GST (or even a transdisciplinary language), so this 'low ambition high confidence' approach has not worked out.

An unanticipated reason for this failure may be that the isomorphies are extracted from the Systemics, and to date the (theoretical) Systemics are discovered not from within the systems community but haphazardly within the specialised disciplines and only generalised afterwards, so the 'generation rate' for isomorphies appears to be both low and erratic.

Boulding's second approach is top-down, and proposes the existence of a structure that would function as a kind of 'gestalt' from which novel or enhanced Systemics could be anticipated on theoretical grounds, and their concrete analogues subsequently sought for and discovered in Nature.

If such a structure were available it would be a very powerful route to new discoveries. Boulding made an inspiring comparison with the *Periodic Table of the Elements* in Chemistry. Although this was incomplete when Mendeleev proposed it, it immediately suggested the existence of undiscovered elements, gave indications about their characteristics that helped design investigations to discover them, suggested valid doubts about accepted empirical findings, and even provided guidance for discoveries outside chemistry (e.g. the substructure of atoms)

However, Boulding's sketch of GST as such a 'gestalt' was unclear or confusing in important respects. Some of these issues were quite subtle, and so it is easy to read "Skeleton" under a mistaken impression of comprehension while actually understanding something different from what Boulding had in mind, and then to reinforce these misconceptions in derivative work.

Some of the problems in Boulding's treatment have been pointed out before, e.g. the lack of clarity in his complexity scale (Mingers, 1997) and in the multiple intermingled hierarchies (Wilby, 2006), but these critics did not completely expose all the confusions inherent in Boulding's description, nor fully correct them.

In this light I consider that the best way forward is to first take a step back, and try to restart his programme in a more conceptually disciplined way. In this way I think we will be able to get properly onto the path he envisaged, and open up a practical route to developing GST in a top-down manner.

4 Interpretations of Boulding's schema

4.1 A purported hierarchy of systems

In "Skeleton" Boulding did not give a diagram of his proposed framework, but only discussed his vision. Although he proposed a 'gestalt' analogous to the Periodic Table, he has been widely interpreted as merely describing a hierarchy of kinds of systems ranked by complexity. He did structure his discussion around what he called "levels of discourse", each of which he labelled, and this seems to have been what researchers have picked up on, and stuck with through the decades since. Here is one way of presenting the list from

"Skeleton", together with the list as given in (Skyttner, 2006, p. 113) and in (Mingers, 1997, p. 306); the latter is reproduced in (Wilby, 2006, p. 697):

Level	Boulding 1956	Mingers 1997	Skyttner 2006
9	Transcendental systems	Transcendental systems	Transcendental
8	Social organizations	Socio-cultural systems	Social organization
7	Human	Human	Human
6	Animal	Animal	Animal
5	Genetic-societal level	Genetic-societal systems	Genetic-societal
4	Open systems	Open systems	Open systems
3	Cybernetic system	Control mechanisms	Cybernetics
2	Clockworks	Clockworks	Clockworks
1	Frameworks	Structures and frameworks	Frameworks

While this list is not uninteresting it is neither enlightening nor inspiring, and is unlikely to stimulate the discovery of anything not already known. However, a careful reading of "Skeleton" shows that Boulding proposed something rather different, but it also shows why he has been so easily misunderstood.

4.2 Key causes of confusion

Boulding's description of what he was proposing suffers from some unfortunate category shifts, poor analogies, ambiguities and inconsistencies. This was partly due to the fact that he was trying to describe something that did not yet exist, and appropriate terms were either unavailable or obscure.

He did not seem to know how best to characterize the schema, variously and inconsistently describing it as

- "a spectrum of theories" (suggesting that he was seeking an ordering of theories),
- "a system of systems" (suggesting an ordering of related things),
- an "arrangement of theoretical systems and constructs" (suggesting an ordering of systemic abstractions and model components),
- "a general field theory of the dynamics of actions and interaction" (suggesting a kind of process philosophy)
- "levels of theoretical discourse" (suggesting an ordering of academic disciplines),
- "a framework of coherence" (suggesting an ordering that is more than just a ranking in complexity).

In setting boundaries and labels for his "levels" further confusions arose:

- The categories of his levels are inconsistent: level 1 represents structures (patterns), levels 2-8 represent kinds of systemic behaviour, and level 9 represents special kinds of facts.
- The naming convention for his levels is inconsistent: level 1 is named descriptively, levels 2-4 are named after abstract system types, level 5 is descriptive, levels 6-8 are named after concrete system examples, and level 9 is named after an assumption about the nature of the facts included there.
- The boundaries of the levels are sometimes set too wide, so the identity of the layer's content becomes confused; e.g. level 4 (open systems) includes both self-maintaining and self-reproducing systems, and here he also includes as examples such things as flames and rivers. His level 9 includes both facts that are fixed points of reference (limits and absolutes) and facts that are references we could never have (the inherently unknowable).

These complications and inconsistencies make it both difficult and of limited value to summarise the schema as he proposed it.[2] However, things become much clearer if we deconstruct *the way in which he built up his description*, and pay attention to *what he said he was trying to do, rather than how it turned out*. If we do this, we can see and understand where and how things went wrong, and with hindsight and contemporary knowledge we can begin to fix some these problems, and also find ways forward that bode well for delivering GST 'top down' as he envisioned was both possible and desirable.

5 In search of the real GST

5.1 Seeking what Boulding sought

Boulding's approach was to try to find a way of structuring the various ways in which systems can behave. In modern terms we might anticipate this would correspond to kinds of Systemics; however he had a different idea, a brilliant one in my view. The first step in his program was NOT to catalog the kinds of Systemics that might possibly exist but rather to identify what he called "units of behavior". These units of behaviour would capture key incremental aspects or properties of certain types of systems, that render them different from other types of systems. For example, he suggested that a key characteristic of an animal is that its behaviour is predicated on "a structuring of information into something essentially different from the information itself" and ongoing addition of new information into that structure, i.e. an animal responds "not to a specific stimulus, but to an 'image' or knowledge structure or view of the environment as a whole". Thus he identified knowledge management as a key aspect of the behaviour of certain systems, of which an 'animal' is an example.

I think the idea of trying to distill and organize "units of behavior" was a crucial insight. Boulding wanted to structure the units of behaviour into a kind of library or vocabulary of general 'model components' that could be drawn on to model any system in particular. It seems as though his method was to use a complexity hierarchy of systems as a stimulus for thinking about the differences in systems behaviour between levels. This was both useful and misleading. As he enumerated categories of new behaviours he quickly ran out of conceptual names (clockworks, thermostats), and had to resort to naming his categories after what he considered to be the most representative kind of system that exhibited the relevant kind of behavior (animals, humans). The consequence was that the list superficially looks like a (not very well defined) complexity hierarchy of kinds of systems. Once it is viewed as a list of aspects of behaviour, it is clear that this should not be a hierarchy but rather a systematic enumeration of differences.

Another consequence is that he set the boundaries of his categories too widely. Drawing on more recent developments in systems modelling, I believe we are now in a better position to identify the smallest incremental aspects of behaviour needed to characterise a new type of system. These could also be viewed as minimal new model components that need to be added to a model of this system type. Once freed from the need to formulate a hierarchy, the systematic relationships between these minimal units of behaviour can be characterised.

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[2] Boulding returned to his schema in a 1984 lecture series (Boulding, 1985), but narrowed its focus to a high-level classification of types of systems ranked by complexity, and hence weakened its potential usefulness for constructing a GST. I will therefore only draw on his more versatile 1956 version in the present work.

There is a further important area in which we can now improve on Boulding's approach. In hindsight, he did not break down the aspects of a general system in a systematic way. A system is not just an integrated cluster of behaviors (and potentials and dispositions) but has those behaviours in virtue of processes enabled by kinds of static and dynamic relationships between kinds of parts. Therefore a framework that represents a GST would have to deal adequately with kinds of parts and kinds relationships as well. He bundled all consideration of structure and relationships into the first of his categories, thus creating another example of a category that is too wide, and in the process he broke the pattern of trying to enumerate 'units of behaviour'. Consideration of kinds of parts (composition) he left out altogether.

5.2 A new vision for uncovering GST and the Systemics we need

Now that we can see what Boulding wanted to do and where and how he ran into difficulties, we can begin to see ways forward to fix them and build the structure he envisaged. There are several ways in which this can be approached, and in my presentation I will briefly outline three such strategies. It is likely that all three will be needed to develop Boulding's envisaged framework, but one of them I think holds the key to building something very like the 'periodic table' he envisioned. An interesting possibility that we can already foresee from work done so far is that this framework will enable new ways of generating and improving Systemics, much as the Periodic Table did for the discovery of chemical elements and the correction of accepted but flawed knowledge about chemical elements. The relationship between GST and the Systemics is illuminated by this new structure, in that the Systemics can now be seen to represent coherent combinations of minimal incremental model components, each such combination thus representing the theoretical possibility of the existence and dynamics of some new kind of real-world system. It thus provides an opportunity to discover kinds of systems, and models of kinds of systems, that are invisible or obscure from other perspectives.

The resolution of the problems our civilization faces will require systemic insights across the board. Given how limited we are in systemic insight in the social and human sciences, the opportunity presented by Boulding's revitalized framework might make a crucial difference in how we find our way to a flourishing future.

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Boulding's social science gravimeter: can hierarchical systems theory contribute to its development?

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Abstract: Kenneth Boulding's Skeleton of Science is presented as one framework of increasing complexity of structures, phenomenon, systems themselves, modeling required to capture their essence, and the complexity of the image each level of the hierarchy holds of itself as viewed by the observer of those systems. The Skeleton is then placed in context of research into hierarchy theory and general systems theory, and discusses how these interwoven areas of research can work to develop new methodologies for transdisciplinary practice, and the evaluation and validation of that practice.

Keywords: Skeleton of Science, Kenneth E Boulding, transdisciplinarity, general systems theory (GST), hierarchy theory.

I speak a mystery: that there is no end
To greatness or to smallness. Did we shrink
To atom's size we would not reach the brink
Of manifoldness, but would see extend
A great new universe, whose atoms rend
Themselves in turn to universes: think
Ourselves but great enough, and all stars link
In one small molecule, whose tremors send
Some speck of vaster light to worlds outside
Our mote of galaxies. This greater world
Is but an atom in a greater, furled
Each one in each, endlessly multiplied. (Kerman, 1974, 7)

1 Introduction

This poem was written by Boulding, (a first draft at sixteen), and this version at thirty-one years of age. It would seem that although his training began in economics, from the days of his youth the pull towards the work of the generalist influenced his writings from the earliest of days. The purpose of this paper is to discuss the hierarchy of system complexity that Kenneth E. Boulding proposed in The Skeleton of Science (1956), and his earlier work: The Image (1956), written during Boulding's residency at the Stanford Center for Advanced Study in the Behavioral Sciences in 1954-1955.

2 The Skeleton of Science

The underlying theme in Boulding's research and writing is always the search for governing principles, rules and system structures. The following quote from his biographer states:

> *"And while he sometimes decries the 'rage for order' that leads man to see order where there is none, it could not be denied by anyone who has read much of his work that one of Boulding's most persistent traits is the seeking of order, the building of specifics to generalities. In 1936, he wrote in the introduction to an ambitious but unpublished work, 'I have a secret and insidious passion for generality and for system'" (Kerman, 1974, 8).*

Boulding worked to discover some system of measurement applicable to the general field of social systems. In this work, he proposed the idea of a social sciences 'gravimeter':
"Metaphor is his natural mode; it seems to come as easily as breathing. But perhaps one of the wildest stretches of imagination occurs in his description of the gravimeter. If, he suggests, the physical world were as difficult to predict as social systems are, with the gravitational constant changing as rapidly as do such vital quantities as the price level or the range of the deadly missile, 'we would literally never know how to get out of bed. On Monday we fly through the window and Tuesday we would crack our head on the floor . . . we would have to have a gravimeter by the bedside to tell us before we even got up whether to make a desperate leap or a gentle movement . . . We desperately need a social systems equivalent of the gravimeter by the bedside'" (Kerman, 1974, 21-22).

Boulding's starting point for a social-systems gravimeter was the Skeleton of Science, consisting of nine levels of organization showing an ever-increasing complexity (Static structures and frameworks, clockworks, control mechanisms (thermostats), open systems (cells), genetic-society systems (organisms), animals, humans, socio-cultural systems (organisations) and, transcendental systems (inescapable unknowables). Boulding is not the only systems thinker to develop such a hierarchy, but he was one of the first to do so in the 1950's. Laszlo, Miller, Kuhn and von Bertalanffy, for example, all proposed similar structures in building their systems theories. However, whereas each of these writers has extensively developed their hierarchies in further writings, Boulding has never returned to his hierarchy in his later writings.

Below the surface of this skeletal structure, however, are four additional ways of looking at the skeleton in addition to this increasing complexity of structure:

- the increasing complexity of phenomenon (which relates strongly to the development of self-awareness (The Image) at each increasing level of the Skeleton),
- the increasing complexity of the systems themselves at each level,
- the increasing level of complexity of modeling required for each of these systems,
- the increasing complexity of the image of the world held by each level of his structure and how that image is observer-dependent (or level-dependent) in its interpretation of its incoming messages.

It is these five viewpoints on the content and context of Boulding's Skeleton that can be further explored using hierarchical systems theories, and the concepts and principles of such theory in developing a robust and responsible general systems approach to the problems of civilization now faced, and as addressed during this meeting of the EMCSR.

Within hierarchical systems, the role of the observer is a core responsibility in defining the system of interest, and thus its scale and resolution, and chosen boundaries. This determination of what constitutes the system of study, allows the application of interpretations of that system, the communication, controls, constraints and containments within and between levels. Using hierarchical concepts in concert with the images of representing and grouping complex systems as developed in Boulding's Skeleton, adds depth to hierarchical systems research.

A further strength from the insights of Boulding's skeleton is an admonition that in our rush to apply complex systems solutions we should be applying appropriate choices of systems solutions, which are relevant to the system of interest, and the complexity of that system of interest. This is also core to the concepts within Critical Systems Thinking and Practice (CST/P) (Jackson and Keys, 1984; Jackson, 2003), underpinning the research and choices made in our research and interventions. Checkland (1981) notes that in connection with levels of modelling, scientific management is a level 2 mechanistic-type model and theory, and goes on to say:

> *"During and after the second World War...the development of cybernetics put emphasis on 'level 3' feedback control systems. Most recently there has been a considerable attempt to bring in behavioral science in order to treat management problems at levels 7 and 8. Thus the historical development of management science can be seen as an attempt to treat its problems as being those of ever more complex*

> *systems. This can be a useful perspective. It serves as a reminder, for example, that a typical management science model constructed in terms of multiple interacting feedback loops, even if complicated, is only a level 3 model and hence can cover only certain aspects of a management problem at level 8. Management scientists have been known to claim more" (Checkland, 1981, 106).*

The Skeleton has been revisited in recent years by systems researchers in the fields of philosophy, education, systems biology, and by this author in the field of management systems and international health policy evaluation (Wilby 2005, 2011). Current work also includes the increasing awareness within systems research of the need for the contribution of hierarchy theory, Boulding's Skeleton and general systems theory in the development, evaluation and validation of current and developing systems methodologies from a transdisciplinary perspective.

It is not surprising that there are no GST models or any other discipline's models that have been successful in modelling at the highest level of perceived hierarchies. As systems become more complex, the fuzzier the image and the more personal and individual the value filters become for those systems, and the more important the individual observer and observer self-awareness, critique and reflection becomes at those points. While Boulding's Skeleton does feel intuitively correct, the problem of increasing complexity in image, message filtering and observer-dependency at the higher levels of the Skeleton will continue to frustrate the search for a working, valuable, 'social-science gravimeter'. It is this search to which this current cited work endeavours to contribute a means for developing such a gravimeter for all sciences.

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II C 2
Ethics from systems: the philosophical perspective

Chairs

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The ancient idea of Greek philosophers, especially of those Stoic protagonists who actively prepared the Roman reception, has been to secure the (scientific) knowledge about nature such that the insight gained could be utilized in order to define a framework of orientation which would provide essential principles of ethics: Hence, in the sense of the latter, human behaviour would be adequate in a well-defined sense, if it could be actually derived from what is according to nature (kátà physin). Although after the medieval turn towards a more Aristotelian approach which was modified somehow in terms of what Christian theology demanded, this ancient idea was not especially popular, it nevertheless persisted through the époques until the late nineteenth century when it showed up again with a view to a possible determination of ethics by physics (in the sense of Baader and Schelling e.g.). Meanwhile, in our days, this position has been taken by the theory of systems, because, as it turns out, this theory follows a universal approach towards describing the totality of what there is rather than concentrating on sections of what is empirically observable. Hence, as compared to the classical sciences and actually different from them, the theory of systems is an onto-epistemic conceptualization which can revive the principles of the ancient philosophical idea mentioned above on the one hand, and reconcile theoretical conceptualization with everyday praxis on the other.

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Inga Gammel: Repercussions of Greek philosophy in modern science
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Repercussions of Greek philosophy in modern science: with focus on Werner Heisenberg and Adolf Portmann

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Abstract: In my paper I shall discuss how the concept of beauty is dealt with in two very different areas of science, namely mathematics and biology.

Keywords: Contemporary science, Greek philosophy, concepts of beauty, mathematics, and biology

Acknowledgement: I thank Rainer Zimmermann for his invitation to participate in his symposium "Ethics from Systems".

From ancient Greek culture springs the idea that the universe is ruled by a divine, guiding principle that produces order and beauty. The beautiful - *to kalon*- dwells at the roots of being and becoming. The beginnings, the contours of this fundamental aesthetic worldview can be found already in the Homeric epic. About 400 years later Plato brings out the philosophical implications of the idea by linking the beautiful with the good and the true. With this famous triad: *the beautiful, the good, and the true* Plato founded a tradition in which aesthetics, ethics, and the search for truth are inter-related.

Since the day of Plato all later generations up to present have had to deal with the question: Does beauty really matters in the search for finding truth? Modernity has challenged the high-flown, idealistic concepts of beauty and the good to the degree that these concepts have been exiled even from philosophy. It has been argued that the idea of *kalokagathia* - the beautiful and the good as a unity - is an archaic way of approaching the world, in other words: It is considered a childish way of behavior.

In everyday life we do know that beauty matters. We may not always consciously be aware of it, but somehow beauty lies at root of our hopes. We hope for the better and not for the worse. But what is the role of beauty when we turn to the sciences? Does the concept of the beautiful play any role at all in the pursuit of gaining scientific knowledge? Or, is the scientist's experience of beauty just leading astray? Is the concern for beauty just a way of smuggling in a cherished hobbyhorse - a toy that might cause the scientist to overlook other important features?

The appearance of beauty definitely catches our attention, but also knowledge might vest in this experience. According to Plato beauty is in the first place the physical, shining manifestation of the good. As we have our existence in the physical world, it might therefore be unwise to neglect the phenomenon of beauty. However, contrary to former times, it is rare today to find scientists that use the concept of beauty. Among those who do are Werner Heisenberg and Adolf Portmann. Then, in my paper I shall discuss how the concept of beauty is dealt with in two very different areas of science, namely mathematics and biology.

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She graduated from the Faculty of Arts, University of Aarhus in 1985 with a Magister Artium in Comparative Literature. She also holds a Ph.D. in Comparative Literature (1996) from the University of Aarhus. She has worked as a research fellow at several cross-disciplinary and international institutions.

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On Schelling's symbolic approach to aesthetics and ethics

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Abstract: The paper addresses Schelling's systemic approach towards aesthetics and ethics, by means of his original account of productive intuition and the thereby expanded aesthetic production that potentially inheres at large in every human activity and conduces thereby to its ethical status.

Keywords: Aesthetics, Ethics, Systems

The paper addresses Schelling's systemic approach towards aesthetics and ethics, by means of his original account of productive intuition and the thereby expanded aesthetic production that potentially inheres at large in every human activity and conduces thereby to its ethical status.

In the first part of the paper, we will initially draw from Kant's interesting insight that considers Beauty as the symbol of Morality. This is argued on the basis of Kant's account of the symbol, succinctly put, in terms of the application of the same rule of reflection on analogous objects of intuition (symbol) and concepts. The latter conceptualization of the symbol, in a way, anticipates the limits of its effects as to the interesting analogy between art and morality, which is thereby confined in the realm of reason excluding nature. Kant seems again perplexed with the paradox of his system, that is, from the one hand Reason claims totality and systematicity and from the other this can only be performed by exclusions and violence against nature.

We then turn to Schelling's idea of the symbolic in the *Philosophy of Art*, whereby we find a more inclusive and interesting account of the symbolic in terms of the synthesis of the schematic with the allegorical, which amounts to the possibility of the representation of the Indifference of the universal and the particular *within the particular*. This account of the symbolic could pay justice to the insightful idea of the beauty as symbol of morality, since by means of this symbolic exhibition, the beautiful is produced by keeping indissoluble the bond with nature. The idea of indifference in this early work seems to account for a free floating coexistence of the universal and the particular, whereby the one transpires through the other in a mutual coexistence and moreover, that the particular is a specific more of *determinate indeterminacy*, exuding an indefinite and infinite meaning, like the grace and the splendour of the Greek gods, through and by virtue of their limitation, i.e. its beautiful form.

The claim for universality is not thereby achieved by the analogy to the moral law but by the symbol of the work of art which, in its limited form, condenses an infinity of meaning, consisting thus a universe on its own and recalling the Leibnizian monad. The key factor for the possibility of such an account proves to be the ontological monism of real forces and productivities that govern both nature and human activity.

The latter procedure is expounded by Schelling's original account of productive intuition in the *System of Transcendental Idealism*, where intellection and sensuality, consciousness and unconscious, reflection and body are intertwined in an interactive polar and dynamic productivity, which by its aesthetic production produces ethics as well, mainly by means of freedom.

The second part of the paper will speculate upon Schelling's idea of the system, drawing on critical conclusions from the modality Schelling develops his systemic approach in the STI, as well as from his positive philosophy.

The relationship between Art, Science and Philosophy will be discussed in the light of Schelling's positive philosophy and metaphysical empiricism. The idea of system will be also discussed through Schelling's *Freedom Essay*, whereby the possibility of the self-explosion of the systematic approach will be related to the critical notion of Indifference.

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Assistant Professor of Philosophy, University of Patras. Did her PhD in Philosophy at Warwick University, with a thesis titled: 'Logic and Logogrif in German Idealism' (under the supervision of Gillian Rose). Main monograph: Challenges to German Idealism, Schelling, Fichte and Kant, Palgrave 2002.

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A dialog about methodological collectivism versus individualism

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Abstract: This paper will discuss the impact of system theory to the question of methodological collectivism versus individualism within a layered system model.

Keywords: Ethics, Philosophy of Information, Sociology, Systems Theory

Methodological collectivism (holism) as introduced by Montesquieu contradicted concepts of methodological individualism going back to e.g. Thomas Hobbes grounding principal philosophical disputes which are still ongoing today. The layered model in system theory of meta system, system, sub system and element points a way of understanding methodological collectivism as a property of meta systems, based on the emergence of new qualities within the new meta system as an entity with own intrinsic characteristics. Methodological individualism as actually represented by James Samuel Coleman, who is also following a lanyard system approach, seems to contradict the system theoretical approach of emergence defended by e.g. Humberto Maturana and Niklas Luhmann.

This leads us to the question how a concept of free will interacts with free actions (liberty) within a system theoretical approach. How does an element (system) with a property of free will, like an acting human agent, influence the characteristics of the system (meta system) it is part of. How does emergence of new system properties on the meta system layer influence the free will of the acting agent (human system) which is defined as an element of this meta system or does this means that the concept of free will has to be abandoned?

To approach these two questions I want to transform them into: What is the impact of the existence of free choice as a property of an element being part of a system? I could also say: What is the impact of the existence of free choice as a property of a system being part of a meta system? But this means, that a general systems theory has to explain the phenomenon of "*free choice*" and locate it within its construct of ideas, going beyond conventional decision theory based on economics, psychology, philosophy, mathematics, and statistics.

This dialog shall contribute to point out the importance of the problem of free will regarding systems theory for the motto "Civilization at the Crossroads" of this conference as a key question for "Ethics from systems", if systems are considered not only as processing, but also acting agents.

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1980 Robert Jahn created an interdisciplinary study program, approved by the ministry of science, of information science combining courses of biology at Vienna University with those of information technology at Vienna University of Technology as a new field of studies in Austria and graduated as PhD. Influenced by the cybernetic approach the idea behind was to apply basic concepts and methods of information technology to biology and vice versa. In the 1990s he joined an interdisciplinary project of the Institute of Design and Assessment of Technology at the Vienna University of Technology investigating the usage of the concept of Information in Ethology and defined information as an attribute of a system, which shows autopoietic characteristics.

In the 1980s he worked as systems engineer and project manager for large international system development projects. In 1994 he became Certified Management Consultant of the chamber of commerce Vienna. As management consultant he focused on information engineering technologies and process management, implementing ERP solutions in various European, international groups. Since 1997 he has been working in the IT management focusing on information management strategies.

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The difficult emergence of rationality from noise

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Abstract: Noise commonly makes us think of a startling or disturbing sound. Beyond this everyday acceptation, however, noise has become an important notion not only in Avant Garde music and popular counter-culture, but also in the natural sciences. In the guise of contingency, indetermination, entropy or chaos, noise plays an increasingly central role in theories of 'self'-organization, evolution, epigenetics etc. Beyond its predominant acoustic connotation, the notion of noise thus partakes conceptually in the statistical approaches to physical, bio-chemical and psycho-dynamic processes, where it connotes contingency at the ontological level, (i.e. physical entropy in a thermodynamic process), but also indetermination at the theoretical level.

The judgment that noise solicits as something unwanted or not useful (just as entropy is defined as non-usable energy) tacitly connects the otherwise disparate aesthetic, ontological and epistemological aspects of noise. Where noise connotes statistical error for instance, the pure calculus of statistical averages becomes tainted with moral and aesthetic judgment: it is not easy to draw the line between noise as random signals and the conclusion that a study was not elegant, badly conceived or even misleading or that the phenomenon itself is somehow lacking clarity or failing to be relevant.

The subtle blurring of the objective and the subjective, of the epistemic, ontological and aesthetic appreciation of noise even in scientific discourse, itself points to a form of conceptual and experimental noise. The blurred boundaries between aesthetic, ontological and epistemological aspect of noise signal more to us than lack of methodological rigor and the philosophical import of this conceptual noise is precisely this blurredness and its place in scientific rationality.

Noise certainly polarizes any given field of inquiry into true or false, right or wrong, clear or opaque, beautiful or ugly, normal or abnormal, good or bad. The growing interest in noise partakes in this dichotomy by valorizing rather than discarding noise as herald of scientific or artistic irreverence towards consensus, as the promise to reverse dominant orders, established rules of taste and norms of thought.

The present inquiry into the problems concerning the relation between information and noise starts from the assumption that the lack of a common ground for a joint culture of science and technology and the humanities offers an incentive for philosophical speculation about the ground of experience and thought. As a consequence, inquiring into the experience of noise implies putting the philosophical stakes in scientific rationality into the perspective of noise: it means looking closely at the difficult emergence of rationality from noise as an act of judgment whose ethical consequences are thus integral to its epistemological function.

Keywords: systems, information, noise, metaphysics, Simondon, Shannon, Bolzmann, interdisciplinarity, transdisciplinarity.

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Ethics at the age of information

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Abstract: Insofar the interactions developed between social, technical and natural agents have been now significantly modified by the new information and communication technologies (ICT), we can speak of a new social dynamic arisen therefrom. Moreover, the central role that information takes in social life has lead us to talk about the dawn of the information age. If we take this seriously, a consequent ethical thinking should start unravelling the tangled skein through rephrasing what information really is and how it can be understood throughout reality. Otherwise, how could we think our proper behaviour embedded in the complex realm of informational interactions of all kind?

In any case, is it feasible puzzling out most appropriate behaviours from the outset –as a sort of optimized code? Or rather, are there fundamental constraints setting the optimum completely out of reach and our whole (cultural) history just the path of the exploration? The globalisation process, developed in strong connection to the deployment of information technologies in very unequal benefit to different groups of the global human system, settles a situation in which the management of the global system complexity is significantly apart from democratic handling, despite the broad usage of democratic facades. Indeed participatory process –concerning relevant decision-making issues– are hard to be found behind these facades. Addressing the issue of inequality at the global scale is in our view a fundamental question of today's information ethics for which an approach based on electronic-Subsidiarity is proposed.

Keywords: information ethics, complexity, globalisation, democracy, ICTs, Subsidiarity, e-Democracy, e-Participation

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1 At the dawn of the information Age

Any historical process, in which the change of social relations is important, usually entails the development of significant ethical reflection. This was for instance the case of the Greek classical period in which the pillars of the western ethics were set up; the turbulent period of the Zhou dynasty experienced by Confucius in which the grounds of this strong tradition was casted; or in more recent times, the emergence of the bourgeoisie in which the liberal ethics –deeply embedded in our globalised societies– were deployed. This is linked to the obvious fact that since new adequate ways of action have to be searched, then new behaviours need to be imagined, thought, deliberated, assessed, and even tried before they crystalize in institutionalized ways of action, that is, before a new morality is achieved. In case the change in the social relations is larger, the required reflection is correspondingly deeper.

If as often stated, we are entering in the "era of information", in which completely new social, political and economic relations are been created, the required ethical reflection will probably last long. Nevertheless since these new relations emerge from the increasing role of information in social life and the space of possibilities derived from the information itself (similarly as the natural properties of iron conferred a new space of possibilities for the societies of the Iron Age) a preliminary stage of the required reflection concerns the very nature of information. Now then, we are far from having a general understanding of information throughout the natural and social sciences, the techniques, the arts and everyday life (Díaz, 2010, 2011, 2012; Capurro & Hjørland, 2003). We find indeed a number of meanings which makes hard the starting point of unveiling the new space of possibilities emerging from the new role of information in our social life as to look for most appropriate ways of action, i.e. to think ethically.

Letting aside the dispute of information concepts, we can provisionally state that information can be generally understood as *what enables the selection of changes in a system*, be the latter of physical, biological, cognitive, technical or social nature (Díaz Nafría & Zimmermann, 2013, 2013a; Zimmermann & Díaz, 2012). Such understanding offers a good interplay with the concept of energy, branded at the splendour of the industrial age, thus offering a clue for distinguishing what the new age might bring about. Whereas energy stands for the possibility to perform changes in the system, information refers to the potentiality of selecting such changes. When the change is performed, the systems is actualised – its structure changes in some manner – and a new space of possibilities is deployed for the system. In other terms, Information drives the energy as to produce some particular change. If we now observe the importance given to energy at the industrial age – even to the point of considering the usage of energy as welfare benchmark –, rooted in the fact that it is energy what enables the transformations provided by an industrial system quite stabilized, the relevance of information, bestowed in our age, relies in the fact that it is the selection of changes in the socio-economical system what comes to the fore.

A good approach to understand this transformation can be done through contrasting an *industrial*- with a *Turing machine*. Whereas in the former, the set of operations is fixed (say stamping a given form into a piece of material) and these can be performed once and again just by providing enough energy, in the latter, it is the *action table* what indicates what operation the machine really performs. The operation can of course be repeated if needed, but the essential point is that the action table may completely change the operations the machine performs very dynamically. If we now extent the comparison to the socio-economic system, the means of transformation – defining the set of actions the social system performs as a whole – can now be in continuous change, in virtue of the information management.

This does not mean that the selection of changes were irrelevant in previous ages. It is indeed the substrate of any evolutionary process in the adaptation of a given being to its dynamical environment (Wiener 1989); but what now changes is the dynamicity of implementing such changes.

In the industrial age, the selection of changes is partially crystalized in the machinery that performs a work which outputs are ‘allegedly’ legitimize by the peoples. The need to adapt the socio-economical systems to their dynamical conditions was provided, on the one hand, through the division and serialization of work linked to the development of durable and reliable machines which in turn set the reach of changes; on the other hand, by properly managing the human organization of industrial tasks which in turn offered the possibility to readapt the productive processes as a whole. This management of human resources established indeed a twofold society composed by the class of the organisers and the organised, i.e. the industrials and the workers. The space of personal freedom, theorised in the liberal ethics, can be grasped as a generalisation of what in the first place is just freedom of choice in the organisation of socio-economical tasks –with respect to the ancient or feudalist mode of organisation–. This freedom of choice was subsequently extended to the liberty of selecting purchase objects –which obviously represents a sort of liberty subordinated to the former.

In the information age, the flexibility of the global machinery of production, steered by information processing, transforms the whole landscape of socio-economic relations and the space of liberty for the social agents. The current possibility to slough off a significant part of the global population from the productive system without any loss of productive ability change completely the game of buying and selling the working force as a fundamental element of the global market, and requires a new social game in which the fulfilment of the Bill of Human Rights (including the economic, social and cultural ones) could really be achieved. To that end, a new value system (able to reflect cherished relations and assets for the global society at large and the earth-ecosystem in which it is embedded) and a new regulation of socio-economic agency have to be erected as to reduce the steady growing inequality and the contradictions of the actual game with respect to its biospherical sheltering. Meanwhile the capability to steer the global economic system through information management, which reproducibility is practically costless, represents a significant risk for a decent human life. For some, information should be socialized as a means to guaranty redistribution of wealth, for others, it is the asset that have to be protected by property laws as a means to keep the economic system running. A thorough reflection on new value systems, as well as on new socio-economical agencies in the global information society as to figure out more appropriate ways of behaviour shall constitute fundamental pillars of the ethical thinking of our age.

Nevertheless, recalling the aforementioned Turing machine model, might this question be translated into algorithmic informational terms as a kind of optimal code capable of deploying best behaviours? On the one hand, Turing machines depend on action tables, which in turn rely on some semantic grounds; on the other hand, there is no computable means to ensure the achievement of the optimal code. Since the semantic grounds are put by humans in the first place, and these have a cultural and historical nature, even the simplified quest of the optimal (computational) behaviour return to the outset: How to act is thus inseparable from *who* is acting and to what *context* she belongs.

2 Democratically seizing complexity in a globalised world

There is a straightforward way to cope with the complexity of a system comprised by too many functional parts and interactions of both internal and external nature: arranging the system in a hierarchical levelism in which at each level its agents follow the rules and mandates given by upper level, interact with other agents of the same level, and manage its constituent subsystems of the underneath level. This is a strategy we can recognize in feudal societies but also in the traditional university order, or in the current industrial organisations which productive relations are spread over the globe –just to provide a few examples–. A similar structure can be also recognised all over nature, though in this case there is no external intention to cope with the related complexity, it is thus self-organised complexity in which new ways of agency may emerge (and it does necessarily emerge in an evolutionary perspective, otherwise self-organised complexity would never occur; cf. Zimmermann, 2012).

Nevertheless, this is clearly alien to the very concept of democracy in which agents operate under relative equalised opportunities and make decisions in a participatory manner (in the case of *participatory* democracy) or through delegation (in the case of *representative* democracy). But, can this concept be properly devised at the global scale? Can electronic means – as considered since the 19th century – serve as a means to deploy democracy globally or even to implement the ideal of participatory democracy (Bingham et al., 2005)? And finally, the inequality we have seen constantly growing globally since the 18th century (Milanovic, 2009) is actually compatible with democracy?

2.1 Globalized social systems

The new geopolitical reality of globalisation clearly overwhelms the cast of the democratic nation-states in which the rule-of-law is still preserved (Dahrendorf, 2001). Such order was actually developed within the nation-states, and particularly in the liberal democracies, in virtue of a continuous negotiation between the capitalist and labour forces enabling the reproduction of the productive relations in exchange for a power balance opposed to the natural tendency of capitalism (Bowles, 2007). But this reservoir of power balance, crystallised in a rule-of-law guaranteeing social rights, has been progressively undermined through several historical factors concerning (as argued by one of the authors elsewhere, Diaz Nafría, 2011): (i) the introduction of automatic production processes; (ii) the networking technologies at the service of the financial, commercial and productive economies; (iii) the constitution and advocacy of capitalist interests by unobstructed international institutions; (iv) the growing power of transnational corporations.

Using Marx's analysis, it is the development of the *productive forces* within the frame of the existing *productive relations* (reflected and legitimized in the *property relations*) that leads to the contradictions between productive forces and relations (Marx 1859). Such process brings about a repetitive obsolescence of the productive relations and the subsequent necessity to re-express them in the existing political frame. This is particularly the case under the capitalist economy in which the productive forces are impelled towards a "free, unobstructed, progressive and universal development" (Marx, 1973: 540).

Hence concerning the liberal democracies, it can be stated that while the productive forces have evolved within capitalist economy, the productive relations and the corresponding property legitimacy have done it in the democratic frame of the nation-states.

This represents an opposition of forces corresponding to a logical contradiction between pure *democracy* and *capitalism*, namely *equality* vs. *inequality*, or *participation* vs. *dominancy*. Its dynamics drives to a recurrent agreement obtained under pressure which terms are updated in constant struggle, at least until the 1980s (Bowles, 2007). But henceforth, the preponderance of the aforementioned historical factors, which origins date back to the early post-war years, have driven to a significantly different situation.

On the one hand, the global institutions represent a new means to press the terms of the agreement with the nation-states, which still legitimate the productive and property relations. On the other hand, the internationalization of productive forces and relations makes that the productive system can flexibly adapt to one or another batch of labour forces to keep on functioning, thus being able to bypass regulatory constraints. And furthermore, the development of automation creates (under the current productive relations and labour regulations) brings about a structural unemployment that impairs even more the negotiation ability of the working forces at the level of the nation-states in which such regulations are kept. In Noble's words who has carried out a thorough and long-term research on the impacts and societal potentials of automation: “There is a war on, but only one side is armed: this is the essence of the technology question today. On the one side is private capital, scientized and subsidized, mobile and global, and now heavily armed with military spawned command, control, and communication technologies." (1995: 3). On the other side, workers are in disarray (and herein knowledge workers have to be counted, cf.: 2011).

Under these conditions the rule-of-law, passed at the level of nation-states and international institutions at the same time, represents the crystallisation of power relations that undermine the average citizen's possibility to cope with their real-life problems, even the most humble ones. In this sense Dahrendorf's liberal advice (2001) of relying on international rule-of-law as a means to spread democratic principles requires an additional prerequisite (similar claims to Dahrendorf's can be found all over the spectrum of European recipes, for instance concerning electronic-Democracy and electronic-Participation: CE, 2009: G44; Millard et al., 2009; OECD, 2009). The case of the European rule-of-law is particularly interesting regarding its alleged democratic values: when the peoples manifested their reluctance to pass the Treaty establishing a Constitution for Europe, the peoples were considered to be wrong and equivalent regulation was adopted through different mechanisms in the form of the Treaty of Lisbon. What is then the democratic value of this transnational rule-of-law? Should we rather speak of façade democracy?

2.2 Democratic participation

It makes sense to seek after the *general will* of a culturally homogenous society, as in the case of the Greek *polis,* or the political communities Rousseau may have born in mind (1913). But if we cannot rely on cultural homogeneity, can we really speak of *general will*?

In the first case, the general will (or *will of the people*) can be articulated in participatory procedures rendering a sort of “government by the people”, and its legitimacy is actually entangled with trust and solidarity which ultimately rest on a deep normative sense of identity and “a shared common conception of history, fate, memory, constitution, and nation” (Moravcsik & Sangiovanni, 2003). This identity makes adhering to the decision of the majority worth for the minorities. And as McIntyre (2006) argues, it is within the small communities where the constitution of such general will can be achieved. He finds just herein the salvation from the dissolving forces of liberal capitalism. Consequently he advocates for “a politics of self-defence for all those local societies that aspire to achieve some relatively self-sufficient and independent form of participatory practice-based community" (Kelvin, 1998: 23).

Nevertheless in transnational contexts – like the European one – the coexistence of different cultures is even worth to be kept, as cultural equivalent of biological diversity of price for adaptive potential. Then even if the small communities are kept as a reservoir or source of virtues (following MacIntyre), we can conceive larger social arrangements as communities of communities… And here we may find a complex set of interests in which commonalities could be unveiled at different levels. Therefore instead of general will, we can here speak according to Moravcsik and Sangiovanni (2003) of "*public interest*". Under this perspective, the government cannot be seen as driven by the people, but rather as "government for the people". The search and preservation of such public-interest provides a legitimacy of a different kind based on the satisfaction of wider classes of "problem-solving concerns" that can be shared by members of various, nested or overlapping groups (local, regional, national or international). Ultimately, the difference between the first type and the second can be seen as just a difference of degree: some common values are also backing the adherence to the public interest. Similarly as we can conceive cultures in terms of (evolving) sets of well-proved solutions to common problems, the legitimacy that may once back up the EU might be regarded as a complex hierarchy of cultures of different granularity.

Nevertheless, according to these authors, not only the EU is far from being able to devise a kind of legitimacy of the first kind (based on the general will), but even concerning the second kind, it has rather "succeeded in thwarting the public interest in favor of a less popular neoliberal agenda. As a result, the EU suffers from an illegitimate neoliberal bias." (2003: 6).

Regarding the potentials of the information and communication technologies to the underpinning of democracy at the global scale, Habermas relies on them for the generalisation of the political archetype, devised in the enlightenment for the international community of scholars, to the global public (1995). Furthermore, he contemplates the hope beyond the representative democracy-reliant nation-state in terms of a deliberative democracy-reliant political organism, based on the equal rights and obligations of citizens (1981). But how is this borderless deliberative politics conceived? Grounded in his theory of communicative action and his discourse ethics, an *activist public sphere* contributes to debates on matters of public importance, oriented to decision-making. However, criticising Habermas, other authors (e.g. Capurro, 2011; Vattimo, 1989; Fuchs, 2010), argue that the alleged public sphere, as a place of purely rational independent debate, has never existed, neither the material conditions are given to its eventual deployment. According to Fuchs (2010), because of "unfair material advantages in public opinion formation (such as through the ownership structure of the mass media) for certain groups [...] Habermas's notion of the public sphere is therefore idealistic". This reproach is quite aligned to the criticism held by the UNESCO throughout half a century concerning the concentration of communication means in a few hands (Mattelart, 2003; Díaz, 2011). Fuchs then advocates for the advancement of a concrete cooperative society (2010).

As mentioned above, the current state of development of the national and international forces makes that often our prideful representative liberal democracies are rather façade-democracies. In this sense, the Information Technologies cannot do, concerning democracy, what the social relations intimately rejects, and therefore we often find *electronic-Democracy* (e-Democracy) facades with no democratic intention behind (Reniu, 2012; cf. CE, 2009). At the opposite pole, we can find bottom-up processes in which the information and communication technologies are successfully appropriated in connection with a collective emancipation and identity construction (Cohen et al., 2012; Gravante, 2012; Golubeva & Ishmatova, 2013). Consequently, several authors consider at the agendas of e-Democracy practise and research (based on thorough analyses of the state of the art in the field) the fundamental objectives of addressing the deepest problems of democracy as lack of real bottom-up participation in relevant matters, power relations, or the foundational aspect of equality and inclusion (Díaz et al., 2014; Sanford and Rose, 2007; Macintosh et al., 2009; Medaglia, 2012; OECD, 2009).

2.3 Inequality and Subsidiarity

Though the aspect of inequality is widely considered in eP studies, this is often addressed in terms of *digital divide* (CE, 2009; Millard et. al. 2009; OCDE, 2009). Nevertheless, this very concept has been shifted from the technological perspective of connectivity to the broader aspect of social inclusion (Warschauer, 2004). The issue is then quite more complex than usually addressed, on the one hand, what the digital divides encapsulates are divides of deeper social kind; on the other, eP at a global scale is hindered by additional divides concerning civic, linguistic and cultural gaps (Macintosh et al., 2009; Díaz & Capurro, 2014). But at the fundamental level of democratic principles in which eP is strictly rooted, we can distinguish a tight connection to equality.

Democracy since its Greek roots is conceived as linked to both equality and liberty (Aristotle, 2004: VI, 2). *Equality* with respect to the capacity to decide upon available common options; *liberty* with respect to the self-determination or autonomy of the community members, who should not depend on some authority in order to make really free choices. Equality thus concerns the right to participate equally (social value), but it also entails that a minimal satisfaction of needs is provided as to ensure real autonomy (material value). Therefore concerning material equity democracy admits a certain degree of inequality, but this is strictly bounded by the need to guaranty autonomy (Post, 2003). As it has been proven, though democratisation can be achieved under inequality conditions, in the long term, it undermines the consolidation of democracy (Houle, 2009) and moreover, it is correlated to the decrease of democratic political engagement (Solt, 2008). This relation has even been stated by the OECD in the report concerning public engagement: “Decision-making is founded on broad participation and equality of citizens” (2009: 146).

In historical perspective, it can be observed that despite the constantly growing global inequality since the 18th century (measured for instance through the Gini coefficient), the localised reduction of inequality has often been associated to democratic processes, as in Western Europe, where the strengthening of social security systems improved the autonomy of the citizens during the decades following World War II (Milanovic, 2009; Jolly, 2006; Cornia, 2004). But since the 1980s, we observe within these countries a heterogeneous increase of national inequality, as well as between EU countries. Again, this provides an additional clue to the EU democratic deficits.

To this respect, it is remarkable to recall that, it was in the context of the dramatically increasing inequality, observed in the industrialised areas of the 19th century Europe, that the *principle of subsidiarity* was developed and incorporated into the socio-political agenda (von Nell-Breuning, 1990). Although the concept is historically rooted in the Calvinistic understanding of community, it was the arisen contradiction between work and capital that made evident the undermined autonomy of the many and subsequently the inability to accomplish the principles of democratic liberalism. Hence, it progressively became a fundamental principle of democratic liberalism, a pillar of the Catholic Church social doctrine, and it is now one of the foundations of the EU who has coded the principle in the following terms: “Under the principle of subsidiarity, in areas which do not fall within its exclusive competence, the Union shall act only if and in so far as the objectives of the proposed action cannot be sufficiently achieved by the Member States, either at central level or at regional and local level, but can rather, by reason of the scale or effects of the proposed action, be better achieved at Union level.” (EU, 2008: art.5). Internationally the principle has been coded as a foundation of decentralization and co-responsibility (UNDP, 1997) and it has been even devised as a core concept for the organisation of complex systems (for instance, in the field of neuropsychology and cybernetics).

In this last respect, there is an interesting historical case not significantly addressed in the e-Democracy literature which actually concerns an early development and remarkably successful case of e-Democracy: the *CyberSyn* project developed between 1971 and 1973 in Chile under Allende’s government. The case is of significant interest because it addresses at a time the issue of democracy, inequality and subsidiarity, and it has been extensively documented, in particular since the last book of Medina (2011, 2008; Beer, 1975; Díaz, 2011). Nevertheless despite Allende’s strong concern of furthering radical democracy in an efficient way, it must be born in mind its direct connection to nation-state political-economy and how the leeway of the latter has significantly changed since, as argued above (sec. 2.2). But the scalability of the organisational core model of subsidiarity is capable to address the additional complexification that should be address in order to handle e-Democracy at a global scale as we will discuss bellow in sec. 5 (cf. Díaz, 2011; Díaz et al., 2014).

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Second-order ethics

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Abstract: In this paper I'll address the subject of the definition of Ethics from the point of view of the systemic proposal of a "second-order Cybernetics". I'll begin by tracing the difference between the systems of Ethics that are based on the belief in the objectivity and in the objective nature of the distinctions between "good" and "evil", "right" and "wrong", in order to clarify the difference from the critical systems, which reject the naive objectivity. Secondly, I'll depict the new critical systems of Ethics as the products of modern Society and the results of the sceptical arguments on the "is / ought question" (D. Hume and G. E. Moore) that became acutely self-conscious with the proposal of a "second-order Cybernetics" in the work of Heinz von Foerster.

Keywords: Ethics; moral discourse; commendations; second-order Cybernetics; observer; objectivity.

I. Naïve moral commands and naïve objectivity

The classical formulation of the object of Ethics, which results from the double meaning of "ethos" in ancient Greek refers to a knowledge of the rules of the adaptation of the human species to their natural environments, to the expectations of the other members of the species and to the transformations of the self-image of the self. Accordingly, a doctrine of the duties was edified on these three pillars, embracing a reference to the duties towards the nature, towards the others and towards oneself. Since ancient Philosophy what we know now as "Meta-Ethics" meant the attempt to the constitution of a theory of morals or a description of morality. Meta-Ethics developed from the description of the actions "according to nature" as the universal canon of the right behaviour to the depiction of the semantics and pragmatics of the moral language and to the observation of specific courses of human action where some rules became mandatory. Meta-Ethics applies to an overarching domain, nowadays divided in the two main areas of the fundamental Ethics and the applied Ethics.

Because Meta-Ethics refers directly or indirectly to human action, it deals with skills of human adaptive conduct in natural and social environments, generally speaking. The fields explored in the applied Ethics may be considered, also, along these two main directions.

In the ancient and modern traditions of the Meta-Ethics the complexity of human action was always at stake, but the ambition of the more traditional ethical theories was to respond to the complexity with simple answers. Notwithstanding the fact that human action obeys to a variety of factors including bio-physiological conditions and the dimensions of the social environment traditional Ethics was oriented to the commendatory discourse about right and wrong, according to precepts of conduct directed to the achievement of defined goals. The ethical discussions consisted chiefly in the investigation of the adequacy of the subordinate goals to the final ends of the human action, the Good Life or happiness, or in the treatment of the metaphysical questions related to the free will or determinism, the opposition of the intentionality of the voluntary conduct of Man to the mechanical or quasi-mechanical responses of the inferior organisms or machines. The Human being and its metaphysical soul were at the core of the classical, pre-modern, representation of Man. Man was described as a creation with special prerogatives and dignity, but also as the final end of the finite God's natural creation. Modern skepticism and particularly David Hume's skeptical arguments regarding the famous "is / ought question" had devastating effects on the traditional Ethics and on its metaphysical support.

The aim of commendations is mainly the determination of what qualifies the teleoconformity of human actions. Commendatory discourse is taken in some contemporary meta-ethical theories as the canonical mode of moral discourse. This conclusion has occurred after a long discussion on the meaning of moral statements in the field of the Philosophy of Moral Language subsequent to the publication of G. E. Moore's *Principia Ethica* and the identification of the "naturalistic fallacy" in traditional Ethics. However, the discussion of the deep semantic structure of the moral propositions can be abstract and oversimplified if one ignores the context and pragmatic use of the moral discourse. The concept of the commendatory character of the moral discourse contrasting with descriptions and descriptive discourse can be misleading.

The difference between the "descriptive" and the "commendatory" seems to be of secondary importance for the understanding of the evolution of morals. More recently,

R. Hare's discussion of the meaning of moral statements may have a semantic importance in the analytic Philosophy of Moral Language but it is of minor interest for the depiction of the social evolution of morals.

2 Second-order Ethics

More relevant in the evolutionary perspective seems to be the notion of a second-order Ethics in contrast to a first-order Ethics. This distinction agrees with the proposal of a redefinition of Ethics by H. von Foerster in his 1991 paper "Ethics and Second Order Cybernetics". Included in the tradition of systemic thinking, this text is a critical discussion of the value of objectivity for the modern science after the cybernetic revolution and the introduction of self-reference and circular causality. In the context of his discussion of a second-order Cybernetics H. von Foerster developed a comment on L. Wittgenstein's proposition 6.421 of the Tractatus with the suggestion of the following English translation: "It is clear that Ethics cannot be articulated". Such impossibility derives from the undecidable character of the ultimate foundation of the predicates "right" and "wrong" when applied to human actions. H. von Foerster believed that the existence of many undecidable questions in axiomatic systems but also in Human action shows the importance of choice and freedom in the emergence of basic distinctions that serve our cognitive or practical purposes. Freedom is the other face of the ethical responsibility in a conceptual scheme that acknowledges the inclusion of the observer in the action or the embedment of the free agent in its responsible acts and choices. In the final part of his paper H. von Foerster suggested to take dialogue as the expression of a multiverse made of multiple choices and responsibilities according to a worldview that can't avoid the inclusion of the observers in the observed domain and the rejection of the naïve objectivity.

In my paper, I'll propose to define second-order Ethics as the descriptive activity that depicts actions from the perspective of the self-inclusion of the agent in the construction of its courses of actions and explains the connection of freedom and responsibility in the social relation through self-referential nexus. Second-order Ethics puts an emphasis on the biographical construction of the Self in relation with others as a special kind of narrative justification of actions.

On the other hand, second-order Ethics demands descriptive conditions regarding moral actions of the agents that are only possible in modern Society. In order to understand the link of modern Society to second-order Ethics I'll take into consideration N. Luhmann's analysis of the modern type of Society's differentiation and his account of the evolution of Morals and the "symbolic generalized means of communication".

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Body meets Lebenswelt: living aspects of ethics according to Merleau-Ponty

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Abstract: The following approach combines the Aristotelian approach to ethics with the basics of phenomenological *Lebenswelt* experience.

Keywords: Social Philosophy, Ethics, Lebenswelt, Phenomenology

The following approach combines the Aristotelian approach to ethics with the basics of phenomenological *Lebenswelt* experience. The practical wisdom of the *ethos* here appears as a situational bodily communication with the world and, simultaneously, as a living origin of ethics. The phenomenological view of *Lebenswelt* refers thus to the human subject itself as it experiences the world. According to this, it is the personal experience that is at the foundation of reality, lying beyond any modern rational world view.

The ancient approach to ethics by Aristotle regards rationality and immediately sensed experience to be essentially one and the same. For actual life, taking Aristotelian thought into account may counterbalance the significant influence with which the sciences act upon the humanities. Aristotle assumes that the subject of *ethos* is human action resulting from a preference which arises out of an attitude appropriate to some given situation. This choice based on personal experience is possible by means of *phronesis* (meaning the rational state of mind). Beside this theoretical approach, the objective of a practically realized wisdom is to find *the golden mean*, i.e. to achieve harmony.

The advantage of Aristotelian ethics is that it looks upon actions as being situational. Furthermore it observes that, in any choice, both the motives and the consequences of an action are taken into consideration. However, on the other hand, this approach is quite close to phenomenology, since it deals with the concrete objects themselves and regards given circumstances as ethically relevant und everyday experience as significant. Another similarity to phenomenology is the concept of a habitualized responsivity appearing as wisdom or *phronimon*.

He or she who is trained in *phronesis* is capable of actually responding appropriately to different situations. If meaning is offered, yet not determined by experience, and if we are therefore requested to evaluate our actual situation by acting, we are dealing with both ontology and ethics – i.e. being and being supposed to – at the same time, the two remaining, however, distinct. The concept of a structure of meaning as described by M. Merleau-Ponty suggests that norms are inherent in things and preformed by these things. Humans possess an a priori knowledge of ethics, values thus being not only developed, but continually rediscovered. Living ethos thus demands an incessant actualizing confrontation with reality and an ongoing communication with a world whose structures we are already familiar with.

The phenomenon of phenomena, according to M. Merleau-Ponty, is the body itself. In his view, physical existence means being in perspective as well as being in situations. Every situation has a structure of meaning which can be experienced physically. Merleau-Ponty observes that our fundamental capability of being the subject of all experience is linked to our situational existence in the world. By means of experience, humans open up towards the Other, the world as well as fellow beings, without being strictly determined. In his physical existence, humans have always been subject to the interdependence of the ethical and the pragmatic.

The world in which humans act physically is a reality that is culturally and historically formed and is still to be formed. Insofar as it is already formed, it does not command, yet advises us what to do. Insofar as it is still to be formed, it absorbs whatever humans are doing. Thus, physical action and *Lebenswelt* are inseparably connected. The bodily countenance corresponds to an inner attitude. Together, they are the embodiment of practical wisdom in an inner and physical mediocrity. Scientific research has shown how changes in bodily reality trigger changes in the inner orientation and the potential of living powers respectively, which also belong to the *ethos*. The body is the system of potential actions, determined by its situation and its functions in the world. Being the substance of practical *ethos*, it is constantly linked with personally lived ethics.

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Quality as seen under an ethical perspective

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Abstract: In this proposed paper, the historical development of the concept of quality shall be discussed, particularly with a view onto Bloch's topic as to the "qualitative measure".

Keywords: Philosophy of Nature, Social Philosophy, Ethics, Aesthetics

For more than two decades the concept of "quality" is abused in various fields, but especially in the world of concrete daily work. After introducing "systems of quality management" in practically all economic fields, other fields of activities felt obliged to follow this tendency by establishing "systems" in order to secure the quality of these respective activities. Hence, more recently, this has become relevant for the public services (including schools and universities), but also clinics, homes for the elderly and so on. Very often, the implementation of these "systems" was accompanied by a scientific framework that provided the founding "theory" for this kind of "praxis".

It is in this way that by now, most of our activities are not simply performed anymore, but they are now topic in an all-encompassing kind of what is euphemistically called "management". And very quickly, the consequences become obvious: Most people report of an increased level of control and time pressure instead of an improvement as to the results and explicit contents of the activities involved.

But it is not only time that gets under pressure: Moreover, a complete submission under the machinery of securing quality is obligatory such that appointments or project assignments as well as project funding depend on it, and those who do not submit themselves have to expect numerous disadvantages for their personal career.

In this proposed paper, the historical development of the concept of quality shall be discussed, particularly with a view onto Bloch's topic as to the "qualitative measure". For Bloch, the measuring of quantities refers to the extensive aspects of objects and takes place in numbers, while the measuring of qualities refers to the intensive aspects and takes place in verbal terms of everyday language. Because the latter entails a strictly intersubjective validity, for Bloch, the measuring of qualities cannot be realized yet completely, according to the historical state of human society. The idea is to eventually reconcile both "categories of measure" (quality and quantity, respectively) which is mainly a task of the future. However, Bloch assumes that the genuine forms of measure to be achieved can be already localized within a "scheme of exteriorization" which serves as the grounding of what follows, chiefly within the fields of nature and of the arts. It is mainly the concept of space that provides a theoretical approach to this. Because this ground to be is based itself on what Bloch calls "the non-relaxed extension of qualitative intensity", there is a dynamical aspect to the evolution of space in social terms.

It is in fact in what Bloch calls „dialectic figures of extraction" (dialektische Auszugsgestalten) that the acting quality is shining forth, mostly within the forms of nature and in the works of art, and by doing so is entailing an explicity ethical dimension in which the ancient mediation of the Good and the Beautiful (kalokagathía) is already irrefutably implemented. The ethical consequences of recent quality management shall be discussed in more detail then.

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Ethics from systems

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Abstract: In this present talk the originally Stoic line of thought shall be outlined, of how to relate the structure and evolution of nature to the explicit framework of an adequate ethics. Different from morality, ethics gains thus the connotation of a science that is essentially founded on principles of a rational and materialistic (as well as dialectical as to that) philosophy which admits recent insight provided by the variety of individual sciences.

Keywords: Ethics, Systems, Philosophy of Nature, Sciences, Theory Design, Praxis

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The ancient idea of Greek philosophers, especially of those Stoic protagonists who actively prepared the Roman reception, has been to secure the (scientific) knowledge about nature such that the insight gained could be utilized in order to define a framework of orientation which would provide essential principles of ethics: Hence, in the sense of the latter, human behaviour would be *adequate* in a well-defined sense, if it could be actually derived from what is *according to nature* (kátà physin). In so far, it would also fulfill the criteria of aesthetical harmony (kalokagathía). Up to modern approaches such as the philosophies of Spinoza, Schelling, and Bloch, respectively, this line of thought has been followed under revised perspectives for a long time. Meanwhile, in our days, this position has been taken by the theory of systems, because, as it turns out, this theory follows a universal approach towards describing the totality of what there is rather than concentrating on sections of what is empirically observable. Hence, as compared to the classical sciences and actually different from them, the theory of systems is an *onto-epistemic conceptualization* which can revive the principles of the ancient philosophical idea mentioned above on the one hand, and reconcile theoretical conceptualization with everyday praxis on the other. In the talk, the basic principles of such an approach are outlined by discussing a prime example from modern physics. As it turns out, the *form* of the concrete theory design will actually determine its contents as well as the possibilities of ethical application.

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II C 3
Emergence in social systems theories and social science: clarifications and applications

Chairs

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"Emergence" is one of the most perplexing concepts that receive critical attention in as diverse fields as systems sciences, philosophy of mind, social theory, and philosophy of social science. Like other concepts that have the potential for guiding scientific research, it contains ontological, epistemological, and methodological dimensions, and has real empirical relevance. However, the attempts to clarify the conceptual issues surrounding emergence are often done in the abstract, without any indication of the empirical implications of the proposed solution.

List of Contributors

Jason Hu: Multi-layer self-organization process (MLSOP) - a framework to understand emergence of social institutions
Andreas Pickel: Conceptualizing cultures in a systemic approach: the case of nationlizing mechanisms
Ricardo Rodriguez-Ulloa: Towards an agency/structure system dynamics practice in the context of the social sciences
László Ropolyi: Crisis development, the postmodern condition, and more

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Multi-Layer Self-Organization Process (MLSOP): a framework to understand emergence of social institutions

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Abstract: Multiple layer self-organization processes [MLSOPs] exist under our noses. They can be identified in many complex systems, e.g. human psychology, organizational and social behaviors, and ontogenesis of social institutions. This paper defines MLSOPs and discusses the relationship of dependency of the higher layer SOPs on the lower layer SOPs.

Using the MLSOP framework, the author attempts to solve a real world puzzle, that is, why the mainland Chinese are not able to build a true constitutional government in more than 100 years. Practical strategic suggestions for institutional and social reforms may stem from this discussion, which should be helpful to all developing countries with the similar problem.

In recent years, the mainland Chinese media are debating whether China should have a constitutional government. The pro and con sides represent substantial political mentality and the reality of PRC's ongoing social dynamics. Chinese people started their struggle of trying to build a constitutional government since the beginning of 20th century. Many mishaps and bitter lessons happened during the previous 113 years. The country has split into two political entities, i.e. PRC on Mainland and ROC in Taiwan. ROC does have a true constitutional government, but ROC has only 1.72% of population and 0.38% of area compared with PRC. Therefore, until today, the majority of Chinese people are still not able to build a true constitutional government nor to reach to a full consensus of the necessity of a true constitution. Why is this so?

To approach this question, let me first introduce two economists, Acemoglu and Robinson from Harvard and MIT. They published a 570-page tome "Why Nations Fail" in year 2012 based on their 15 years of research, refuted a number of popular hypotheses, and promoted their own institution hypothesis, trying to answer a vital question "why are some nations poor and others rich?" The book has been praised highly by a big number of scholars, including at least five Nobel laureates [K. Arrow, G. Becker, P. Diamond, M. Spence, and R. Solow], and opinion leaders such as Francis Fukuyama. Therefore, it is quite fair to say that this book represented a mainstream academic thinking at least in the field of economics.

Their main point is that, open pluralistic political system leads to "inclusive" institution, which leads to sustainable growth, while "extractive" institutions tend to end up poor and unsustainable. The luck of getting the inclusive institution is sometimes based on "accidental circumstance," or "critical juncture." Geography or culture, according to the authors, should not be explanations of whether a country can obtain prosperity, only institution can explain. However, the authors do not provide precise definition of inclusive and extractive institutions, just offered rough descriptions – extractive institutions are those extracting wealth from groups of society to benefit a small group, while inclusive institutions provide open opportunities to everyone in the society. In other words, "it is freedom that makes the world rich," quoting I. Morris praising the book.

Bill Gates has criticized this book as "disappointment, analysis vague and simplistic," in a book review on his www.thegatesnotes.com. I agree most of Gates' observations, but I would like to say more from a cybernetic perspective. Economists may sometimes use cybernetic concepts such as "feedback" or "self-fulfilling prophesies", but most of time they do not see circular causalities of various types underlying the phenomena that they target to explain. In order to understand "why some nations are poor and others rich", linear causality models [in the format of "X causes Y"] do not work at all because they cannot really capture the complexity of what exactly going on.

More specifically, this book falls short to explain my question at the beginning, i.e., why Chinese people cannot build a true constitutional government in mainland for more than 100 years? A true constitutional government is the first step towards the "inclusive institution," even some constitutions are not "inclusive." A constitution is an explicit overall agreement of the members of the society. Without a true constitution the society is far from "rule-of-law," it might be in absolutist monarchy, totalitarian despotism, or rule-by-covert-jungle-law. During the over 100 years, China went through a good number of "critical junctures", but why the Chinese, except those retreat to Taiwan, are not capable of achieving inclusive institution, not even a true constitution that gets implemented?

No economist nor sociologist has provided a satisfying answer to this question so far. In this paper, I try to use self-organization theory as a tool to decipher the dynamics of human institution formation, to answer the key question raised at the beginning.

1 Questions for discussion

1.1 Formalism for SOP

First, I need a simple formula to capture the essence of Self Organization Process, for the purpose of simplification when I need to discuss multiple levels of self-organization later. The classical explanations of self-organization [i.e. by Ashby and by Von Foerster] did not provide such a formula, so I need reader's input to help me choose one from three possible representations:

A: $R_e=L_e(M_e)$, or, Eigen-result = Eigen-Loop (Eigen-mechanism), where

- "Eigen-mechanism" (M_e), is the stable/unchanging behavior of elements;
- "Eigen-loop"(L_e), the recursive function implemented by a circle of causalities (the Loop) connecting the behaviors of elements); and
- "Eigen-result" (R_e), a stable result (Eigen-value) generated from the process going on around the Loop; or

B: E=R(A) or Emergence = Rule (Agent), where E,R,A can be specified for any SO cases; or

C: R=Ǒ[M], or Results=Ǒ[Mechanism], in which Latin capital O with Caron is used to represent the general self-organization process. The letter "O" visually symbolizes a closed loop of causality in focus. The bud-looking "Caron" visually symbolizes something growing from that circular causality and sustaining by this causality loop, i.e. emergence.

The reader will see in later discussions that such a formalism is needed for convenience when we get into the efforts of describing multi-layered self-organizations. Which one of the above three communicates better? I'm asking reader's opinion, like a vote, better providing some reasons. For now let me stick to format A even some colleagues already indicated that they prefer B or C.

1.2 Self-organization and emergence in a more general and abstract view

In 1995 at "Einstein Meets Magritte: An Interdisciplinary reflection on science, nature, human action and society" conference held in Brussels, I attempted a synthesis on six different perceptions of self-organization/emergence phenomena and tried to use the above mentioned formula A to capture one isomorphic pattern/principle among various versions of self-organization (Hu, 1999), i.e. $R_e=L_e(M_e)$.

In the simplest case of simple linear causality, i.e. A causes B, we do not have a loop here, or, like "direct line" can be perceived as a circle which has a radius of infinity, we have R_e= B and M_e=A while $L_e()$ = null.

In the case of one loop feedback, both negative or positive, if, in traditional engineering representation, the transfer function of forwarding path is G(s), of feedback path is H(s), of the closed loop is Gb(s) = G(s)/(1+G(s)H(s)), then, in our representation, R_e= Gb(s), M_e = G(s) + H(s), L_e = the loop formed by G(s) and H(s) linking to each other.

In the case of Ashby's self-organization, take his "universe of numbers" exemplar (Ashby, 19XX), M_e is the status of the "universe of numbers", L_e is the looping operation of multiply any two randomly chosen numbers and putting back the product and multiplier back into their niches, as described by Ashby, and R_e is the final result when the whole universe stabilized. I.e. all zeros.

In the case of Von Foerster's self-organization, take his "magnetic cubes in a box" exemplar (von Foerster, 19XX), M_e is the ways that magnetic cubes are constructed, L_e is the operation of "shaking", i.e. repeating interactions of the cubes, and R_e is the final structure emerged inside the box.

In the case of Prigogine's self-organization, the dissipative structures, multiple interactive loops are identified, M_e is the set of reactions that participating the system being observed. L_e is the looping structure that one equation's dependent variable becoming the independent variable of another equation and vice versa. R_e is the observable structure that emerges.

In the case of Eiken's self-organization, multiple levels of loops are identified and called hypercycles, in a similar but extended framework.

In the case of Maturana's self-organization (autopoiesis), the (outside) loop becomes the identity of the system. Life equals coordination (between the body and the environment) of coordination (inside the biological body). Society, or institution, equals coordination (communication) of coordination (between the individual and its environment) of coordination (of the psychological and biological processes within the individual). We are starting to see the multiple layer here.

The complexity of the above systems increases like on an invisible ladder, from simple mechanical systems such as automation servo devices, to more complex systems in chemistry, biology, physiology, psychology, and sociology.

In the current representative of a "collective intelligence" product, the Wikipedia, the entry "self-organization" highlights a number contributors to the concept: Descartes, Adam Smith, Immanuel Kant, W. Ross Ashby, Warren McCulloch, Heinz von Foerster, Gordon Pask, Stafford Beer, Norbert Wiener, Ilya Prigogine, and Niklas Luhmann. The entry also reviewed observations and related perspectives of self-organization in a long list of disciplines: Physics, chemistry, Biology, Mathematics, computer science, networks, linguistics, sociology, economics, behavioral finance, anthropology, economics, and of course, cybernetics. The entry also mentions, as examples of self-organization in the form of the emergence of collective intelligence, such as "global brain", "Society of Mind", Wikipedia, Gaia philosophy, deep ecology, ecology movement and Green movement.

Nevertheless, the authors of the entry article comment, and I agree, that:

> *As the list (summarizing and classifying the instances of self-organization found in different disciplines) grows, it becomes increasingly difficult to determine whether these phenomena are all fundamentally the same process, or the same label applied to several different processes. Self-organization, despite its intuitive simplicity as a concept, has proven notoriously difficult to define and pin down formally or mathematically. It is entirely possible that any precise definition might not include all the phenomena to which the label has been applied.*

Such comment revitalizes my intention of pushing my 1995 synthesis about Eigen-Mechanism further, and trying to re-describe it more clearly.

Overall, the concept of "self-organization" points to a process through which a macro/global structure/order evolves/emerges, over time, from micro/local interactions among the agents/actors inside this "self." Here the "self" is a system defined by an observer, and agents/actors are the elements of the system. Unlike the traditional definition of system S={E, R}, (System={Elements, Relations}) where R is a pre-defined set of relations among the Elements, in a self-organization system, R emerges by itself as (self-organizes into) either a stabilized set of relations (a structure, such as a certain shape of a network), or an Eigen-result that becomes observable at the macro level.

I prefer "Eigen-result" than "Eigen-value" because in many cases, the "Eigen-value" is not a numeric value! It could be a tree, a concept, a P-individual, an ethic principle, a human organization, or a political system. Call them "result", of one or more than one process(es), pre-determined (i.e. Eigen-) by invariant, unchanging principles hold at the local level of the elements/agents/actors of the system, through recursive (looping) interactions among them. *(For readers unfamiliar with self-organization theories, some daily examples needed here.)*

These goes back to my previous formula $R_e=L_e(M_e)$, which could be viewed as an extended version of causality in traditional sense. The traditional concept of causality, A causes B or M causes R, is a special case when the Loop L_e does not close within the boundary of the system defined. (*examples here*)

Here I would like to emphasize that, in the $R_e=L_e(M_e)$ model, R_e must either be an observable structure, or a stable, harden, solid result, in Gordon Pask's word "hard carapace." The latter is especially significant when we start considering multiple levels of Self-Organization processes. The R_e established/stabilized could become a building block, or an element of another larger system at next level of observation, to enable self-organization process at the next level.

1.3 Hypothesis One: multi-level self-organization (MLSOP) and globalization

Even the Re=Le(Me) model may describe many instances of self-organization and/or emergence as listed by the Wikipedia entry mentioned above, here I prefer to limit my scope of description only on the reaction chain of human behaviors from very local to very global. I.e., from as micro as the knowing-doing process inside individual brain [cognition and decision], to the interactions among many brains [communication and organizational behavior], to political-economic-cultural activities that form societies [institutions], all the way towards the interactions of different societies leading to, in the future, a global organizational Eigen-result of the whole planet [globalization]. Although the task of identifying such a list of processes on different scale of systems are not easy, and may sounds too bold, it is actually more specific and perhaps more useful than most of existing versions of "theory of everything" that are too grand to have utilitarian value.

Also, even the relationship between "self-organization" and "emergence" is still a topic of debate – some perceive them as identical and some as different, I shall take a side, for the time being, to opinion them as identical, and for the simplification purpose refer the concept as SOP in following discussions.

The first level of SOP is **the formation of "concept."** Gordon Pask define "concept" as "a procedure to bring about a relation." I would define "concept" as a R_e, while here M_e is the activities of all neurons cells contributing to the formation of this particular concept, and L_e is the reaction loop from sensory cells to motor cells through both the computing neuron network inside the brain and the object in the environment as the target of this cognition process.

This process of $R_e=L_e(M_e)$ might be going on like this: "beep… beep… beep…Hmmm…there is something here… beep… beep… beep… this… beep… beep… beep…is… beep… beep… beep…ah-ha!… beep… beep… beep… a table! "

There might be different levels of SOP of concept-forming going on within one brain (or more), leading to different types of concepts on different abstraction levels, [i.e., per Elliott Jacques], such as, "this particular table"(object), the abstract word "table"(symbol), the collective concept "furniture", and the universal concepts "convenience, utilitarian value, facility,…etc." For the time being, let us assume these processes are all accomplishable within one brain without other human's involvement…

We may have at least three types of L_e here. The first is without involvement of other human being, just the brain doing cognition with its physical environment. The second is with one human being (communication). The third is with a group of human beings (collective consensus forming). We immediately have three basic types of concepts: (1) unique-for-A: $R_{eA}=L_{eA}(M_{eA})$; (2) agreed by two brains A and B: $R_{eAB}=L_{eAB}(M_{eAB})$, and (3) shared by a Group: $R_{eG}=L_{eG}(M_{eG})$.

It must be noted that, compared with type (1)(concept), the late two type (2)(agreement) and type (3)(consensus) are formed by SOP at higher levels, because the system (the Self in SOP) are enlarged, and both agreement and consensus are not built by "beep… beep… beep…Hmmm…", but by clearly defined concepts jumping between or among different brains. In other words, in the process of $R_{eAB}=L_{eAB}(M_{eAB})$, the "elements" are no longer the sensory signals as in $R_{eA}=L_{eA}(M_{eA})$, but R_{eA} and R_{eB}. The same is true for $R_{eG}=L_{eG}(M_{eG})$. That is to say**, the formation of agreement and consensus** are on the second level of SOP performed by human being.

Thus we know that, without clear definition of concepts, any communication, and any effort of consensus building (co-ordination of co-ordination in Maturana's term), among muddy-headed humans will be extremely messy or impossible. Because R_{eAB} or R_{eG} cannot emerge – even the system (the "self") is there, its "elements" are neither well defined, nor able to hold their position yet, so with no stable "elements with unchanging principles," no "self-organization" will be possible! This explains a number of observations of social problems in underdeveloped societies like China. *(Add examples here.*)

At the third level of SOP, we are getting the third-order R_e - **Beliefs** (propositions, meanings, sentences, statements that are hold as "true" by a brain); **Memes** – Beliefs that are easily transferable across brains; and **P-individuals** (an interrelated, connected, and consistent set of beliefs, i.e. a chunk of "entailment-mesh" in Paskian term.

At the fourth level of SOP, the fourth-order R_e emerges as **Public Moral Codes/Ethical Codes/Cultural Values/Norms** of behavior, in a society, or a system formed by a group of P-individuals. Here the elements are independent (but interacting) P-individuals, and the product of $R_e=L_e(M_e)$ are in publicly domain – they are shared by people that form this society. The interactions among P-individuals may leads to at least two types of results here: (1) A stronger/influential P-individual "eats up," or assimilate, all other potential P-individuals. This is the situation of cultural slavery. The ultimate example would be a famous saying describing China between 1966 and 1976: "800 million people, one brain." (2) Many well-developed P-individuals having the capacity of "holding their own ground" and forming consensus through effective communications. This is the situation of democracy.

Belief-Behavioral-Codes[BBCs], or Cultural Gene Codes, or simply collective behavioral principles, which emerge at this level as shared by most individuals in a society, might be the root causes of the stable form of the organization of this society, especially its political system. A BBC is an operational instruction at the individual level, expressible in the format of IF x THEN y1 ELSE y2 BECAUSE z; or IF [current cognition] THEN [action 1] ELSE [action 2] BECAUSE [internal model/theory/working hypothesis/belief].

The fifth level of SOP produces **Organizations/Institutions**. Primitive fourth level R_e produces primitive types of organizations. Highly developed or sophisticated fourth level R_e produces advanced organizations. The “primitiveness” and “advanced level” of organizations can be measured and compared. [*link to paper “Organizational Friction Coefficient*”]

Among many possible organizations emerged at the fifth level, one particular organization grows into a government, which defines/forms the state. States self-organized into “United States”, “European Union,” “United Nations”… etc. They become, as the interactions among them develop, new level of elements forming the ultimate system on this planet – the global society – which has been “self-organizing” since early history till today. Therefore, the sixth level of SOP is **Globalization**. The elements on this level are not only the independent states, but also multinational companies, multinational NGOs, and world organizations in trade, transportation, health, etc. defining various relationships among the “elements” or participating organizations. Earlier stages of this process were showed in the format of wars, trades, and colonialism. After WWII, milestones such as the forming of United Nations and a number of world organizations emerge. This sixth level SOP features the spread of democratic governance in politics, the globalization of the planet economy, and the spread of universal values in cultural arena.

To summarize, MLSOP of our observation, from processes within one brain to the process happening on the whole planet, contains six layers. The emerging Eigen-results at each level are: (1) concept; (2) agreement, consensus; (3) belief, meme, P-individual; (4) moral/ethical code, cultural value, Belief-Behavioral-Code; (5) organization, institution; (6) global village. The main point is that what can emerge from each higher layer is dependent, visibly or un-visibly, on the stability of the Eigen-result generated at the previous level.

1.4 Hypothesis Two – Extractive Institutions and Inclusive Institutions Are From Different Cultural-Behavioral-Codes

Now if we agree the above multi-layer SOP framework, we are ready to come back to our core question at the beginning, “why Chinese cannot build a true constitutional government so far?” Since institutions are at the fifth level of the multi-layer SOP processes, the answer is that Chinese Belief-Behavioral-Codes at the fourth level prevented them from doing so. We can predict that, if those BBCs are not changed successfully as in the case of Taiwan, there is no hope that China will build a true constitutional government sooner.

Using the same framework, we can reveal the secret behind the two types of institutions that Acemoglu and Robinson discussed. The inclusive institutions are built on a more advanced set of BBCs – personal freedom, equality as social norm, encouragement of creativity, independence of individual, justice, rule-of-law, etc. The extractive institutions, on the other hand, are built on BBCs that believe in violence, hierarchical relations as social norm, obedience, conformity, dependence on a larger group (i.e., family, “*Unit,*” the party, the state), “*Guanxi,”* etc.

About the Author

http://www.asc-cybernetics.org/links/cyberneticians.htm *and a full vita at* http://www.wintopgroup.com/team/jixuan/jjh-vita.pdf *]*

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Conceptualizing cultures in a systemic approach: the case of nationalizing mechanisms

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Abstract: In the tradition of Bungean systemic philosophy, this paper explores the problem of what kind of systems, if any, cultures in general and nations in particular are. The author, who has a long-standing scholarly interest in nations, has not found a to him satisfactory solution in the work of Mario Bunge.

Keywords: social systems, symbolic systems, mechanisms, systemism, Mario Bunge, philosophy of social science, nationalism, nationalizing mechanisms

Two fundamental questions are raised by the problem of cultures in systems thinking. Both are ontological. First, are cultures social systems, semiotic systems, symbolic systems, a combination or none of the above? Do they even exist? Implicit in scholarly work on nations and nationalism, one can find approaches corresponding to each of these possibilities, though few have any interest in systemic thinking. While the research area on nations and nationalism has arguably thrived on ontological variety and pluralism, and thus has no particular need for the kind of analysis presented here, systemism must confront the problem of culture.

The second question is whether cultures may be working as mechanisms (processes) rather than just being around as systems (structures). The systems/mechanisms distinction is fundamental in Bunge's philosophy. In a symposium on Mario Bunge's social philosophy (Pickel 2004), one of the contributors, Colin Wight (2004), argues that since social systems are shot through with symbolic systems, i.e. social systems are, or contain, semiotic systems, there surely should be semiotic mechanisms. Bunge (2004, 374) insisted that "by definition, a mechanism is a process in a concrete system". Symbolic systems are of course not concrete (real) systems but conceptual systems and therefore only show process if moved by a real system. The problem in the social sciences, however, is generally that, in addition to many artifactual languages that are symbolic systems, many social systems such as families, seminar groups, work collectives, and indeed ethnonational groups, operate only in part with the help of symbolic systems (whether Facebook or business English, not to mention all the scientific symbolic systems). In addition to making use of many formal symbolic systems, online or off, all social systems are fundamentally based on an informal operational code - a natural language, a dialect, various vernaculars, professional jargons. The social and the symbolic here are naturally or de facto intertwined in social (i.e. sociocultural) systems. Thus by definition, social systems are irreducibly sociocultural systems, producing sociocultural *processes and mechanisms*.

While this may appear as a rather remote philosophical problem, I have followed it through in my own work by modelling "nationalizing mechanisms", an important global species of sociocultural *mechanism* that cannot be adequately modelled as a social *system* (a territorially organized or state-society) plus symbolic *system* (nationalism). The nation never acts, bleeds, or kills, but the real actors who do these things operate within and make use of nationalizing mechanisms.

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Bunge's and Wight's contribution are in A. Pickel (ed.), "Systems and Mechanisms: A Symposium on Mario Bunge's Philosophy of Social Science, 2 parts. *Philosophy of the Social Sciences*, Vol. 34, No. 3-4 (June and September 2004).

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Towards an agency/structure System Dynamics practice in the context of the social sciences

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Key words: Social Paradigms, SD, SSM, SSDM, Agency, Structure, Voluntarism, Stakeholder

In the last years there has been a great concern on which could be the role that System Dynamics (SD) can play within the Social Science; first of all, as a framework to analyze social phenomena and secondly, in order to design and implant policies which can be used for maintaining the society´s status quo or, on the contrary, to make changes in the social arena, looking for a betterment of the conditions of human beings and the environment involved in a specific situation.

In this line, new challenges have appeared for SD nowadays, being one of them the need to do something to move it from its traditional structuralist–functionalist practice towards to transform it into a systemic methodology which could integrate what usually has been considered a dichotomy in Social Science: the agency versus the structure approach in the study of social phenomena.

The Agency tradition believes that social phenomena are outcomes product of the actors´ voluntarism expressed in actions which define possible scenarios in a social portion of the real world. Thus, this approach is interested in studying the desires, fears, aspirations, interests and power, among other aspects, of the/those stakeholder(s), who try to impose his/her/their worldview(s) (i.e weltanschauung/weltanschauungen) over others in a particular social arena, where he/she/they has/ have a kind of influence and power to implant changes, including radical changes in that situation. Under this approach individuals, then, can be considered as main actors who define some possible directions in society´s future.

The Structure tradition, on the other hand, believes that the path of society is defined by its structure existing in a defined space and time. So that, human beings and their actions in society, under this approach, are mere elements of what the structure defines in a particular society. Then, if some changes are wanted to be made in it, these have to come through changes in the society´s structure first.

SD usually has been seen as to be a social systemic methodology which practices a structuralist-functionalist approach in its analysis and policy proposals, in searching for improvements to be applied in social phenomena.

The present paper argues that doing some innovations in the SD approach, with the contribution of other systemic methodologies, concretely Soft Systems Methodology – SSM, it could integrate the Agency/Structure dichotomy, becoming, in this manner, a systemic integrative approach that first of all, dissolves this dichotomy in studying social phenomena, and secondly, it could be an approach which can offer an innovative ontological, epistemological, methodological and human´s role approach based on systemic, phenomenological, hermeneutic and epistemological roots that using a feedback causal loop formal language for doing systemic interventions in the social arena, is able to propose and implant viable policies for diverse stakeholders involved in a specific social situation.

Soft System Dynamics Methodology – SSDM, a methodology developed by the author, product of the fusion of Soft System Methodology (SSM) and System Dynamics (SD), is proposed as an option to achieve this Agency/Structure SD integration, making it possible to move SD from a realist, objectivist, positivistic and structuralist–functionalist instance to a nominalist, interpretive, phenomenological, hermeneutic, epistemological, critical and voluntarist approach that using a feedback causal loop language can lead to the practice of a common formal language among social scientists, allowing the co-construction of a common social reality among stakeholders, through the practice of what Lane and Oliva have coined as dynamic coherence, expressing their desires, intentions, purposes and accommodations in the internetworked web of the social phenomena occurring in the real world.

For its argumentation, the paper starts presenting the Social Sciences context, following the classical framework proposed by Burrell and Morgan, showing a brief review of the classical sociological paradigms of social theory and then explaining briefly recent social theory developments. Afterwards it shows the evolution of SD since its creation by Prof. Jay W. Forrester at MIT (USA) at the ends of the 50s, till nowadays, presenting diverse “SD schools” according to the paradigmatic approaches each of them have taken, following, for doing this, the work done by Prof. David Lane at LSE (UK), to arrive to the explanation of what SSDM is, and to argue about the possibilities to adopt an integrative agency/structure SD practice through the use of it.

The paper ends with some learning points about the issues concerned to this paper and a reflection on further research that can be developed in the line of an agency/structure integrative SD practice, from the discussing aspects considered in the present paper.

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Crisis development, the postmodern condition, and more

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Abstract: The crisis can be contemplated following the teachings of Aristotelian philosophy, and it can be described by using the concepts of possibility and actualization. We will call these viewpoints critical, crisical or postmodern and finally dialectical or hermeneutical. Based on this analysis crisis can be considered as an understanding of transformation (desorganization and reorganization) of organisms/systems/networks/totalities.

Keywords: Crisis; Systems; Organism; Development; Dialectics; One; Many; Postmodern

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First of all, we would like to characterize shortly the worldview of a society in a crisis. Our starting point is that in a crisis, all processes and elements of the social system become connected and commensurable and can come into an interaction with all other processes and elements of the society. The whole society becomes similar to a huge, infinitely sensitive body. Very small and very distant effects can produce strong and quick reactions. The value of independence and individuality wavers, the value of uniformity, conformity and cooperation increases.

The most important aim in a crisis is shared and essentially clear for everyone: to put an end to the process of the crisis as soon as possible; this is what mostly motivates the actions of the members of the society. During crises, most people easily accept that some kind of universal power (God, the state, law, the Big Brother) can rule over the individual.

The main challenge of crises is choosing well from the various presented alternatives, possible aims and value systems. Perhaps we could characterize this situation by saying that the concept of the many plays an essential role in the worldview of a society in a crisis. (We use the concept of the many and later the concept of the one following the Ancient Greek philosophical tradition.) In order to understand the worldview of a crisis, we can talk about worldviews dominated either by the many or the one. The worldview of a crisis is the worldview of the many, at the same time, the mechanistic worldview is the worldview of the one. There is no freedom in a world dominated by the one, there are no decisions; this is the realm of absolute necessity. Necessities are not effective in a world of the many, decisions can be taken; this is the realm of absolute chance. Of course, we do not encounter these rigidly separated versions in reality but their transitions, that is, crises can be characterized as processes displaying levels of development. During their progress, the relationship between the many and the one is characteristic.

During the unfolding of crises, the totality organizing effects which have functioned well so far (production circumstances, ideologies, worldviews, paradigms, styles, etc.) lose some of their efficiency; the belief in a single worldview wavers and worldviews become plural. The earlier accepted version of the relationship between the one and the many in which the one dominated in a certain way loses its validity and temporarily the many is in the forefront until they find new, unifying forces. The crisis of the modern state of the world, just as in case of all other crises, can be approached through at least three clearly distinguished viewpoints. The crisis can be contemplated following the teachings of Aristotelian philosophy, and it can be described by using the concepts of possibility and actualization. We will call these viewpoints critical, crisical or postmodern and finally dialectical or hermeneutical.

The viewpoint of the critical attitude is still strongly connected to that which still persists and dominates the understanding of the world and which it wants to criticize. The critical viewpoint is interested in and kept alive by the changes of the prevailing views which have already became possible while pluralizing is still only a possibility here. It is easy to notice that in times of crisis, philosophies called critical multiply and there are only a few treatises. Such kind of thinking is usually insensitive to the multitude of obstacles which the changes following from the criticism have to face. A more detailed analysis of the critical attitude can reveal its romantic, absurd and utopist versions. The viewpoints which critically evaluate the modern state of affairs are still a part of modernity.

However, the sensitivity to the changes in progress disconnects viewpoints from the prevailing views. With this, the reference, the stable point, the control of reality also disappears. Reality is dissolved, pluralized and made relative. Thus, the world of the many, which cannot be unified, starts to speak. The spectator of the crisis cannot look out of the process; he is drifting in it; the meaning and possibility of all comparison is lost. We call this standpoint crisical since it is a product of the deepest crisis; its typical form is irrationalism.

Its version forging ahead from modernity is the postmodern attitude. Pluralization is an important value here and precisely this is what is happening; it is only plurality which exists without any doubt.

The changes which took place, the crisis, which run its course present the prevailing view as something changed, something different. If we notice and follow the tendencies unfolding from the processes, the discordance and inequality of the chances, alternatives and values and compare what can be compared we get out of the attraction of the many and we construct a single reality from this infinite world going to pieces, then we will transcend this contemporary pub through this dialectics and we reach another world from this one. The world of reality, developed and understood as the realization of possibilities is open, complex and changeable.

In this way, it is not so difficult to see the ubiquity of crises in the human culture and history. Shortly, crisis can be considered as an understanding of transformation (desorganization and reorganization) of organisms/systems/networks/totalities.

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Theme III
Complexity and strategy

About the Theme chairs

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III A 1
Systemic consulting

Chair

Louis Klein, Systemic Excellence Group, Berlin, Germany

Since the world is learning about systemic problems, the idea of providing systemic solutions in consulting and advisory became some extra public attention. Yet, what are we looking at today if we revisit systemic consulting? Systems sciences as such have taken a few paradigmatic turns over the years. How was this reflected in the disciplinary set of models, methods and instruments of systemic consulting? What are the trends? Where does the community of practice go? Complexity is an issue. Yet, the reduction of complexity makes systems fragile. The way to resilience embarks on Ashby's law of requisite variety. Hence meeting complexity seems to be one of the critical challenges of systemic consulting. What are promising approaches to do so in theory and practice of systemic consulting? And finally systemic practices have always called for a more holistic and integrating attitude. For this they are acknowledged by those communities working towards global responsibility of human action. What could the contribution of systemic consultants to globally responsible practices look like? This symposium therefore aims at bringing together the practitioners in the field of systemic consulting to reflect on the development of the field, the current state and discuss the future of globally responsible consulting and advisory practices.

List of Contributors

Marko Bohanec, Ricardo Rodriguez-Ulloa: An intelligent decisions room for dealing with strategic management complexity: combining soft systems methodology (SSM) with expert systems (ES) in a Peruvian experience
Allenna Leonard: The proprioceptive organization

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An Intelligent Decisions Room for dealing with strategic management complexity: combining Soft Systems Methodology (SSM) with expert systems (ES) in a Peruvian experience[1]

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Keywords: Strategy, complexity, root definition, conceptual model, expert systems, multi attribute decision making, culture, complexity, organizational learning.

[1] A first version of this paper was presented in the "Systems Thinking in Europe" Conference held in Huddersfield, England, in September, 1991 and organized by the United Kingdom Systems Society (UKSS); however the paper was not published because it arrived lately for the book´s publication. This version is an update one, enriched by recent developments in five fields of knowledge: soft systems approaches applied to strategic management, collective learning organizations, knowledge management, applications of expert systems in strategic management, as well as the conceptualization design and use of Decision Rooms as an environment for collective strategic management and learning for/ in organizations.

The present paper is an account of an experience done by the authors at the beginnings of the 90´s, as an innovative action research project done in the Peruvian reality where soft systems methodology was applied as the main tool for conceptualizing the present and future of one of the main Peruvian private business groups at that time, combined with the application of expert systems (artificial intelligence), in order to design an intelligent Decisions Room for the integral and systemic management of the mentioned private group.

Thus, a Decisions Room was conceived to address the complexity that arose in the strategic management of the mentioned Peruvian private business group.

To carry it forward, an expert system was developed to capture the reasoning of the managers of the organization responsible for the strategic management of the Group. This expert system was designed to act as performance´s evaluation instrument of the Decisions Room. To achieve this goal, Soft Systems Methodology was used, while also taking into account the unpredictable environment of the Peruvian reality existing at that time[2]. Thus, it was necessary to establish the basic root definition of the Organization's primary task, its conceptual model and the respective indicators for strategic performance follow up. To achieve this task, the stakeholders of the problem situation were involved in its preparation.

This knowledge was subsequently placed in a computer environment, using software tools such as DEXi, a computer program for building expert systems for multi-attribute decision making, in order to effectively address issues concerned to the organization´s strategic performance. The tool thus developed needed a proper work environment: a Decisions Room, which was achieved by systemically combining techno-ergonomic, social, psychological, cognitive, linguistic, power, policy and cultural aspects for it. In addition, the effects of introducing emergent technologies in traditionally managed organizations and the experience of ensuring their acceptance was an issue considered at that time and is discussed in this article.

Finally it can be said that the Decisions Room, conceived under the combination of soft approaches and artificial intelligence, now better than at the time when we carried out this project, can become a very important tool for achieving the strategic transformation of Latin American organizations and elsewhere, improving the management of the inherent complexity existing in any organizational management, changing the organizational culture, the distribution of power and management style and improving the quality of corporate decision-making process.

It contributes as well as to improve the collective learning process (Checkland, 1981; Wilson, 2000; Senge, 1991, Senge et. al, 1995, Senge et. al., 2000) making explicit in organizations which adopt this approach, the tacit strategic and operative knowledge (Nonaka and Takeuchi, 1995) existing in managers´ minds within organizations.

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[2] The beginnings of the 1990´s were for Peru very difficult times due to the intensive terrorism activities made by Sendero Luminoso (Shinning Path) and the MRTA along Peru, combined with an accumulated inflation of more than 800%, which made Peruvian´s environment a very difficult scenario for private enterprises to survive

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The proprioperceptive organization

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Keywords: Prioperception, Viable System Model, Homeostat

Metaphors enable people to look at organizations and their patterns of relationships through a different lens and detach themselves from the familiarity that allows assumptions to go untested and environmental change unrecognized. There are many metaphors for balance as well as many evidence-based descriptions and mechanical devices. Different ways of being in balance are important to both individuals as physical and social beings and to organizations. Entrepreneurs, especially need to conserve their resources and attention so as not to become overwhelmed with peripheral activities and stumble. Disturbances to maintaining a balance come from the larger society as well: economic, ecological and social change have effects that resonate broadly throughout the larger system.

One of these notions of balance is the sense of proprioperception. As individuals our proprioperceptive sense anchors our movements in space as we move. It is usually unconscious but can become conscious when engaging in activities like Tai Chi or the exercise of standing on one foot with our eyes closed. We normally don't think much about it, as repetition becomes muscle memory. Training and/or retraining the proprioperceptive sense has become more prevalent in preparing for sports, maintaining agility and flexibility as we get older and when recovering from an injury. I began to wonder if attention to such activities might be as useful for organizations.

In the human body, particular parts of the brain and receptors maintain balance and enable the body to 'right itself' in motion. The organization also has internalized means of righting itself that may or may not be consciously labeled as such. However, in a time of rapid change and emerging challenges the organization also might benefit from making the unconscious conscious and assigning attention to this factor. Organizational fitness (Schwanninger, 1993) and viability (Beer, 1979,81,85) have for decades been part of the organizational systems and cybernetics toolkit.

Working in the context of Stafford Beer's Viable System Model, it became obvious that major balance points (or homeostats) were worthy of their own further investigation along with its management functions and communications channels. They include the balance between the system and its environment, the autonomy balance between vertical and horizontal instrumentality, the balance between the present and the future (the Three/Four homeostat) and the balance between the System (management functions one, two and three) and the Metasystem (management functions three, four and five) at each level of recursion. They also include the homeostats in the larger environment that set the contexts in which the organization operates.

The task of these activities is to manage complexity (here referred to as variety) in a way that makes sense for the time frame and the environment and that satisfies Ashby's Law of Requisite Variety (Ashby, 1956). This is done by a combination of amplification and attenuation to gather the information to keep a central variable within acceptable limits. This is what most models do: select the salient features, focus energy on them, and leave the rest for another model at another time or another observer with another perspective.

Organizations, like individuals, find balance more difficult when buffeted by disturbances such as uneven ground or turbulence. Sometimes it is necessary to just ride it out and allow the relaxation time to elapse. But when the frequency of disturbances is faster than the relaxation time, organizations and individuals have a hard time returning to equilibrium. (Beer, 1975) For both, they can improve through extending their sensory apparatus and channel capacity and through practice. Acquiring one's 'sea legs' while on a voyage is one example. Building a model that identifies threats and tipping points and using real time monitoring of key indices is another. Sensing instability while it is still incipient may give enough time to steer away or minimize its effects.

Everything hinges on the balance between the organizational system and its environment. This first homeostat balances offerings to the environment with identified needs or markets. There are a number of ways the lower variety organization can address the needs of the much higher variety environment. The first step is to make the environment aware of its offers by describing the product and distinguishing its products and services from others in the field. Various types of advertising, demonstrations and other means amplify the message of the organization. It is also necessary attenuate the greater variety of the market so that their customers can be identified and reached. They may consult census data, do market research, seek a location on-line or the High Street where their customers will find them and follow up to find out what they liked and what could be improved. Beer's 'Chart Four' (Beer, 1985) is a template to map the messages they wish to convey and how best to communicate them so that they are seen or read by the intended audience. Next, it maps responses from the environment and interprets them. The chart is shown with three homeostatic loops although there will be many more and they can be described for each product. How this information is used is the job of the operational management however that role is defined. This function is always on the lookout for emerging developments and new learning. It listens to both its contractual environment and to different and emerging aspects of its contextual environment.

Entrepreneurs and small business can benefit from external resources to attenuate the aspects of their environment that are not directly connected to their main business. Organizations that provide flexible time hot desks, meeting rooms and other facilities to business and non-profit groups who do not need the formality of leased premises on a daily basis are a good example. They may also provide networking opportunities or easy access to a translator or other special service. Governments can help small organizations with the regulatory requirements that, in many cases, are designed for larger businesses. Within the Viable System Model framework, many aspects of System Two and some aspects of Systems Three and Four might be farmed out to others at reasonable cost.

The autonomy balance between horizontal and vertical authority can go awry either when decisions within operations take insufficient account of the needs of the rest of the system or when other management levels micro-manage direct environmental interactions. As a general rule, the people closest to the market know it best so there needs to be a good reason for intervention. The VSM's communications channels relating to this issue are the command channel (ideally limited to issues of legal/ethical compliance and identity) and the two-way resource bargaining channel between Systems Three and One, the System Two coordination to keep System One activities from getting in each other's way and the Three Star or audit channel that exists to mop up excess or sporadic variety.

The next important balance is the Three/Four homeostat that adjusts the twin needs of keeping the current operations going (the 'inside and now') and preparing for the future (the outside and then). This varies greatly for different organizations and for the same organization or industry at different times. The maturity of the market, the rate of change in the field, and the type of product or service all affect this balance. Weather and environmental or technological change, different population patterns and outside economic factors may all introduce turbulence into a formerly stable business.

The system/metasystem balance encompasses the Three/Four homeostat with the added function of the organization's identity and its interpretation of normative behavior. How well does it fit with the level of recursion above and below it and with its full complement of stakeholders? Even when an organization is independent, that is, not part of a larger legal entity, it will be embedded in other more comprehensive structures such as the local community, the regulatory environment and its type of business. Has the organization committed to becoming sustainable and reducing its energy footprint, providing learning opportunities for employees and customers or using fair trade suppliers? This is where the system/metasystem homeostat comes into play.

A final balance looks outside at the environment. What forces and influences are changing and what responses need to be rebalanced as social, political and environmental changes occur? One way to proceed is to identify one balance point at a time (whether it is one you wish to maintain or to change) and look at it from an outside perspective. Given that the current circumstances are perfectly designed to produce the situation as it is, (Veltrop, 1991) what is keeping things in balance, keeping virtuous circles in place and inhibiting the growth of vicious circles? As a general rule (Vester, 2007), there should be more negative (or error correcting) feedback loops than positive (or growth enhancing) feedback loops so the whole system is able to change without collapsing.

Looking at these homeostats from the perspective of proprioperception may yield new insights or help to identify and strengthen existing conscious or unconscious balancing mechanisms. Building agility and resilience is a good strategy for survival in an environment whose ecology, economy and governance structures are in flux.

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III A 2
Systemic project management

Chairs

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While in contemporary society projects support the creation of considerable, economic and social value, still we miss out opportunities, as we have become accustomed to projects failing with rates up to 70 per cent. Projects rarely fail due to technical challenges. Project Management (PM) as we know it seems deprived of solid ground whenever different interests, opinions and ideas come together, whenever political concerns and cultural differences come into play. Certainties take a tumble and along with them, the entire project. How do projects gain stability in the face of political and cultural complexity? Initiatives such as the International Centre of Complex Project Management (ICCPM) are first steps in the process of finding meaningful ways to deal with complexity. The nature and origins of PM have always intended to reduce complexity instead of following Ross Ashby's law of requisite variety and looking for ways to enhance its inner complexity to cope with the complexity of today's projects. However, in contemporary project management, projects are often considered as complex technical systems. This leads to the understanding that projects are technical endeavours and thus are managed as such. Project Managers have been educated in reducing complexity, and often focus on technical solutions, instead of a more holistic perception of a project in its specific context, including for example the different interests of project stakeholders. We stress the perspective of projects as social systems, which leads to need for managing project structures as well as project contexts. We name this approach to managing projects Systemic Project Management.

List of Contributors

Gu Jifa, Xu Shanying, Fang Yong, Li Qianqian: Some complexity problems in Shanghai World Expo in 2010
Louis Klein: Social complexity in PM revisited
Ursula Kopp, André Martinuzzi: Systemic project evaluation
Christian Majer: The performance oriented organization: theory in action
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Some complexity problems in Shanghai World Expo in 2010

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Keywords: World Shanghai Expo; Complexity; self-organization, self-similarity; Hurst index; systemic management

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Shanghai had organized the World Expo during May 1 to October 31, 2010. Over 73 million people visited Expo 2010 during the 184-day event, breaking the previous record of 64 million visitors set by Expo 1970 in Osaka. Organizers had expected 70 million visitors at the start of the expo. Since the number of total visitors had arrived to 73 million, and 192 countries and 50 organizations registered to participate in the Shanghai World Expo. The queuing phenomena may be confronted everywhere in Expo. In front of some pavilions the largest queue length arrived at 6000 visitors, the longest waiting time was around 11 hours. So how the organizer and managers managed the affairs for serving the visitors efficiently and effectively and in avoiding the crowding accident was the big problem for social systemic management? For this purpose organizer mobilized a lot of service staffs, volunteers and security staffs including armed policeman for solving the management, also asked a lot of researchers in the fields of system science, operations research and information technology in helping them to analyze the systemic management. By using various advanced IT equipments, such as monitors, electronic eyes, mobile phone system, internet and information processing center, they collected a lot of data and information related to the numbers of total visitors in the various gates and in different pavilions timely, also gather a lot of knowledge related to the control queuing and crowding accident. In the previous two years (2011-2012) we had paid much attention into the research on the queuing phenomena by using Operations research in the physical aspect, then we also paid attention to the behaviours of visitors waiting in the queue and volunteers who are working for Expo by using psychology in the psychological aspect [1-4]. But in the last year of 2013 we started to pay attention to the properties of complexity taking the World Expo as a whole system in the social aspect. We studied two important properties in the study of complexity: Self-similarity and self–organization. We use the Hurst index to measure the self-similarity in the time series of the total numbers visitors per day for the whole Expo and the individual pavilions especially related to the queue length H_L and waiting time H_W. It is interesting to point out that nearly all the values of Hurst indexes (H_L and H_W) for the individual pavilions are within 0.5 and 1. We also found that these two indexes H_L and H_W for the individual pavilions as random variables are distributed normally and between two indexes H_L and H_W also exist correlation lineally. Then in general speaking the intentions of visitors for visiting the Expo are autonomous, independetly but also influenced interactively with the neighbors, environment and the public media propaganda, this visitor's behaviors are self-organization, but in fact in the first days of May the number of visitors were only 0.2-0.3 million, much less than expected average 0.40-0.60 million of vistors per day designed by organizers in advance. Then the organizer make effort to improve this situations, it means they take measure to mobilize people to come visit Expo with reduced prices of tickets or with order from top authority, we may call they are hereto-organization, we calculated two indexes for describing this phenomena: the portion of visitors by self-organization over the total population of visitors per day varying from 25% to 90% in whole period of Expo; the Hurst index for total visitors H_T =0.815 , one of visitors by self-organization H_S =0.802 and one of visitors by hereto-organization H_H =0.990 [5-7].

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Social Complexity in PM revisited

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Abstract: In referencing social complexity, it seems that a problem description has been found that, at the very least, reveals the difference to traditional project management and opens the door to a space of solution into which we have yet only ventured a few steps. It is unfamiliar to think about political and cultural aspects in project management. However, initial experiences are promising.

The paper is an exploration of the existing possibilities, which make dealing with social complexity ruitful for project management. After a brief, fundamental consideration of complexity (II.) and strategic complexity reduction (III.), the inevitability of the social (IV.) is considered against and with the backdrop of practical experience in change management (V.).

This allows then, in the sense of Next Practice development perspectives (VIII.) a shedding of light on the instrumental manageability of the practice of the political (VI.) and the cultural (VII.). Finally, the conclusion (IX.) will provide an answer to the primary question: How can the exploration of social complexity further develop and improve the capabilities of project management?

Keywords: social complexity, politics, culture, Next Practice, strategic complexity reduction

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Systemic project evaluation

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Abstract: Today numerous projects aim at fostering Sustainable Development, increasing their complexity tremendously: They increasingly deal with interdisciplinary sets of targets and touch upon different topics at the same time (e.g. economic, social, environmental), they address a higher number of actors in different fields (e.g. business, research, administration), and they involve several levels of implementation (Multi-Level-Governance). Actors from different levels are supposed to work together and to reach economic, environmental and social targets simultaneously. Consequently, the evaluation of such projects needs to be able to consider this complexity, too. Evaluators need to be able to grasp the complexity of the system under evaluation, to consider actor perspectives and mental models, and to mirror contradictory perceptions and aims. We adapted Systemic Constellations - a method already well established in organizational development and systemic consulting - for the use in project evaluations, which we call Project Actors Constellations. It is a rather quick interactive method that can provide profound insights into the social system of a project. Project Actors Constellation can supplement any project evaluation method, by thoroughly revealing the mental models of the actors and the stakeholder relationships within the evaluated system, and thus enhancing the development of the evaluation design and evaluation questions.

Keywords: Project management; evaluation; audit; systemic; constellation work; systemic constellations; systems approach

1 Complexity of projects

Looking at projects as social systems according to Luhmann (1995) is quite new (eg. Engwall 2003, Gareis 2012 et al.), but seems appropriate as the internal project structures, the project environment as well as the relationships of the project with its contexts (Gareis/Stummer 2008) plus the respective stakeholders expectations (Heitger/Sutter 1990) need to be considered. And in the context of sustainable development and corporate social responsibility, also the short-, mid-term and long-term outputs, outcomes and impacts as well as the local, regional, and global aspects need to be considered together with the underlying values, next to the balancing of the economic, ecological and environmental orientation. (Gareis/Huemann/Martinuzzi 2013).

The endeavor to consider all of the mentioned aspects increases the complexity that needs to be included in a project evaluation. International discussion on evaluation methods is moving towards systemic approaches in evaluation (e.g. Baumfeld et al., 2008; Cabrera et al., 2008; Dyehouse et al., 2009; Hummelbrunner, 2000; Hummelbrunner & Williams, 2011; Patton, 2011; Williams & Imam, 2007).

2 Systemic project evaluation

Using a systems approach when carrying out an evaluation, gives the opportunity to pay attention to different stakeholder opinions and coalitions, to power and boundary issues, to the project environment, to link across opinions, sectors and disciplines, to acknowledge the richness of real life, to account for dynamic changes and the unexpected that can emerge, and to identify leverage points (Hummelbrunner 2011, Williams & Imam 2007; Morell 2010). In order to gain that, it is useful get additional information about the actors´ constellation by revealing thoughts, motivations, beliefs, and rationalities of the actors involved. As this kind of information is held by the actors themselves and is rather implicit than explicit, it cannot be gained from official program documentations and also not very easily from interviews. Therefore, such a tool needs to be practical, it should be rather quick and easy to use by the evaluator in a workshop setting and it should have the capacity to reveal mental model (Funnell/Rogers 2011:103; Senge 2006:8) of the key actors of a project.

Systemic evaluation methods currently in use, such as, Cognitive Mapping, Social Network Analysis, System Dynamics, Soft Systems Methodology, Circular Dialogue, Convergent Interviewing, Story Telling, Critical Systems Heuristics, Outcome Mapping, Viable System Model etc. focus on relationships, perspectives or boundaries, but are either very time consuming or do not contain a specific tool to uncover mental models.

3 Project actors constellation as new evaluation tool

In the course of the search for an appropriate method we analyzed systemic methods being used in organizational development, psychology and therapy. Inspired by rich picture, a part of soft systems methodology (Checkland 2000), and role play, we finally adapted a method originally developed for family therapy and later transferred to organizational development: constellation work, and tested it in 14 evaluations. At the end of the 1990s several European authors started to transfer family constellations to organizations and other systems (e.g. Grochowiak/Castella, 2002; Groth, 2004; Sparrer, 2000, 2006; Varga von Kibéd, 2000; Varga von Kibéd/Sparrer, 2002; Weber, 2000), where it is being used in a number of endeavors, such as consulting of enterprises, administration and policy making. (e.g. Gminder, 2005; Kohlhauser/Assländer, 2005; Roevens, 2009) and recently also in the stakeholder analysis in project management (Huemann 2013)

Systemic constellations aim at understanding the interrelations of parts of a system in order to be able to develop new solutions and to promote change. It is a spatial representation of the internal picture one has of the relationships, orders, hierarchies, dependencies and communication patterns of a system (Grochowiak/Castella, 2002:19). This explicit and implicit knowledge is arranged in space, using either persons or figures (wooden figurines, puppets, shoes, cards on the floor etc.) as representations of parts of the system (e.g. Roevens, 2009:83).

Sparrer (2009:17ff) describes constellation work as a language of the whole system, which is more than the verbal and nonverbal communication of the single representatives within, but the communication between them, a kind of sign language Schlötter (2005:201).

Thus multi-dimensional and multi-layered information of the actors mental models is provided in analogue form as a picture, supported by spoken language. Such pictures are easy to understand and show deeply rooted structures and dynamics of a program, which can usually not be found in official program documents and are also not easy to get through interviews. It is a method that simultaneously allow emotional, affective and cognitive experiencing and learning for individuals, groups and evaluators (Kopp & Martinuzzi 2013). Constellation work, preferably implemented at the beginning of the evaluation project, can have direct consequences for the evaluation design: new or different evaluation questions can arise, different or additional actors can be deemed important and needed to be interviewed or other evaluation criteria might be developed.

Project actors constellation can be understood as qualitative method of data collection, similar to interviews, and, as action research due to its openness. The unavoidable intervention in the evaluated system that happens by applying the project actors´ constellation is small, not more than with other methods, and therefore acceptable. The correct implementation, however, needs to be done by experts experienced both in evaluation and constellation work. As to every method there are limitations to be kept in mind: confidentiality of the situation versus transparency requested from evaluations, the findings in a project actors constellation can be used for conception considerations only, and not as objective evidence as sometimes required from evaluations. Some people might refuse to offer a constellation picture with a lot of insight, and the evaluators need to be aware that it can only be a snapshot and might change over time – much like interviews. Keeping all those limitations in mind, project actors constellations are highly useful for gathering input for the development of a logic model of the project, and for refining the evaluation questions, by adding the actors´ perspective.

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The performance oriented organization: theory in action

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Abstract: This paper reflects the concept of an integrated management approach, the performance oriented organization (P.O.O.), by using the system theory of N. Luhmann. The purpose of this presentation is, to bring together the discussions of impact research and Corporate Social responsibility (CSR) on the practical side and systemic thinking as a theoretical approach with distinct values and attitudes on the other side. The main questions for the discussion are: 1. Can the P.O.O. provide an approach to better understand organizational activities, such as processes and project in respect to the internal and external impacts? 2. How can systemic thinking influence practical work in project management?

Keywords: Performance Oriented Organization, Project Management, Process Management, Knowledge Management, Quality Management, Impact Measurement, Stakeholder, Corporate Social Responsibility, System Theory, Theory of differences.

1 The performance oriented organization is based on systemic assumptions

The Performance oriented organization is a concept based on the project oriented company with additional organizational topics like Strategy, Process & Quality Management and also Knowledge Management. It shall be discussed both, first how the above mentioned management topics are linked to each other and secondly what value may be generated by using a systemic view.

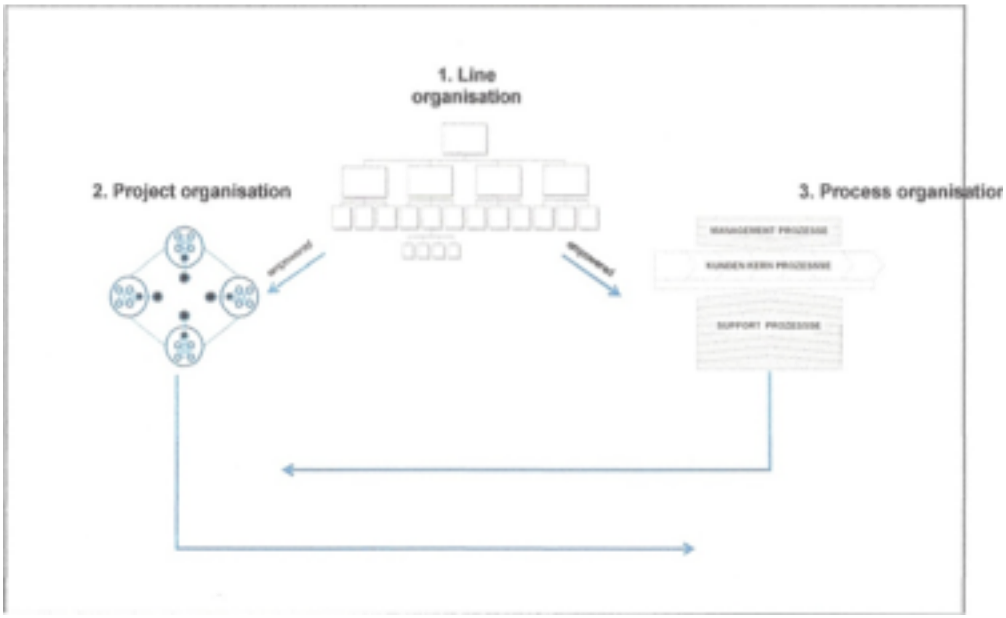

Figure 1: The Performance oriented organization (Millner, Majer 2013)

1.1 How are the management topic linked to each other in practice?

Often Projects, Processes or Operations, Quality and Knowledge are managed isolated, head by different responsibilities within in one organization. Therefor it rarely sums up to a focused approach. The integrated management system, the performance oriented company (Millner, Majer, 2013) will be first lined out briefly.

1.2 What can be seen with a systemic view?

Based on Luhmann's (1984) system theory and on Spencer-Brown's (Spencer-Brown (1969), Baecker (1993a, 1993b), Ortmann 1995) theory of differences, the above mentioned management approach will be reflected with a systemic view. Tight and loose couplings will be analyzed.

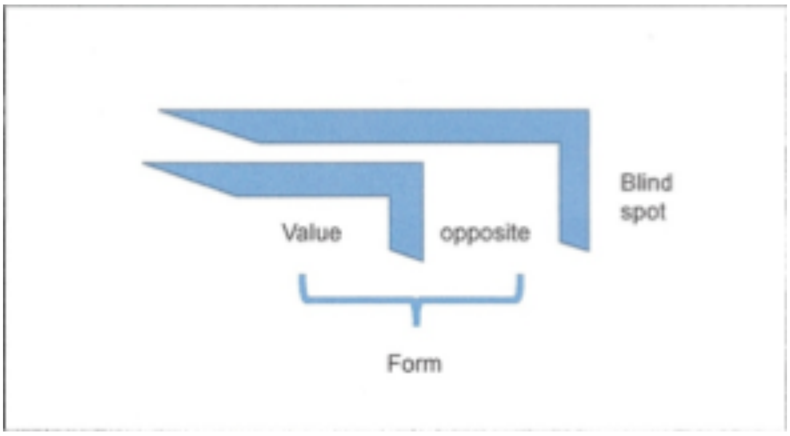

Figure 2: Laws of form (Spencer Brown 1969)

Different kind of observing-codes or forms (values/opposite) that are used by each social system, like project teams shall be identified. It is further indented to find blind spots, coing along with the forms. And finally, consequences for other both, social systems and individuals, inside or outside the organization shall be discussed.

1.3 What are the theoretical and practical implications?

The results of the theoretical review will be used for analysis of practical implications within and outside the organization (respective stakeholders). Using this approach, more awareness for internal care taking and social responsibility sharing shall be shown up.

The paper intends to light up a bit more the role of organizations as social responsible actors in a current society of organizations.

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Systemic methods for sustainable project management: a case study

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Abstract: Sustainable Development (SD) principles are of relevance for different social systems such as the society, organization, but also for projects. We define SD as values based concept including principles such as balancing ecologic, social and economic orientation; short-, mid- and long-term orientation; as well as balancing local, regional and global orientation. While many companies claim that they consider SD in their business efforts, there is little evidence that projects are adequately equipped to deal with this contemporary demand. Based on the assumption that to explicitly consider SD principles in project management increases the project management quality, but also challenges project teams to deal with the complexity, we experimented with systemic methods to allow project teams to better grasp the social complexity.

We present results from a case study project of Siemens Ltd., in which we experimented with a systemic board to integrate SD Principles into Project Management. The case study project was an engineering, procurement and construction (EPC) of a wind park farm in an underdeveloped area of Brazil of Siemens Ltd. We will share our experience and show selected project management plans such as a stakeholder analysis, project organization chart and a project risk analysis we developed with the project team. The case study was part of an international explorative research study on Integrating SD into Project Management conducted by WU Vienna.

Keywords: systemic project management, project stakeholder management, project risk analysis, project organization, sustainable development, systemic board

Acknowledgement: We would grateful thank the whole case study team of Siemens Ltd. in Brazil for their openness to experiment with new working forms and sustainable development.

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III A 3
Country development in a time of globalization

Chairs

Paul Balonoff, Ballonoff Consulting
Tatiana Medvedeva, Siberian State University of Transport, Novosibirsk
Stuart Umpleby, The George Washington University, Washington, DC

In the new century the challenge of globalization is to develop the rules and institutions for more effective governance at the local, national, regional and global levels in order to preserve the benefits of global markets and at the same time to create the possibilities that human, community and natural resources would work not only for profits, but also for people and the planet. This symposium will cover a range of topics concerned with how institutions and societies are adjusting to rapid technical, social and political changes. Each paper will make some reference to ideas from systems and cybernetics. This symposium will continue the conversations among scholars from East and West that have occurred in past EMCSR conferences. Many of the participants are from post-communist countries, which are experiencing political and social changes in addition to the technological changes and globalization affecting Western countries.

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Ontological theatre of art, science and technology: a cybernetic journey from digital culture to artificial life

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Abstract: Paper examines influence of cybernetics on artistic practices with new technologies as well as emergence of XXI century digital culture. Following A.Pickering's rethinking of cybernetic theory as 'ontological theatre' author examines intersections of aesthetics with science and technology in cybernetic, digital and hybrid art and provides arguments for technology driven cultural dynamics from digital culture to post-digital culture of artificial life.

Keywords: science art, cybernetic art, digital culture, artificial life

Acknowledgement: Prepared with support of Open Society Institute for Policy Analysis and Studies of Technology Research Centre of Tomsk State University.

Artistic experiments with technology demonstrate how art can be an “early warning system” (in Marshall McLuhan sense) (McLuhan, 2001) of what is going to happen with culture and society. Appreciation of technology was a driving force behind vanguard movements such as futurism and constructivism transformed into Bauhaus design and modernist perception of progress. In 1950-60s artists discovered creative potential of cybernetics and future technologies inspired by this approach. Decades before digital computer revolution of 1980s and social robotics of 2000s cybernetic art became a future-sensitive way of constructing and shaping technological civilization. Robotic sculpture works of G.Pask and N.Schoffer, in algorithmic painting of M.Mohr and C.Schuri, experimental theatre performance by D.Kluver and J.Cage – all the cybernetic art movement was an anticipation of upcoming digital culture.

What is crucial for cybernetic explanation of the world that made people from art and culture so enthusiastic? As Andrew Pickering explains in his important historical account of cybernetics in Britain (Pickering, 2010), these ideas are focused on understanding any phenomenon as included in complex interactive configurations. Pickering describes it as ‘ontological theatre’. That is why cybernetically designed technological objects are so close to functioning living organisms generalized as ‘complex adaptive systems” (Holland, 1975). And that is why American art historian J.Burnham used the term “artificial life” (long before this term was coined by C.Langton and Palo Alto complexity research group) in his aesthetic analysis of robotic sculpture presented in his influential book “Beyond modern sculpture” (Burnham, 1975).

Ontological theatre and cybernetic art helps us to explain complex nature of technology driven social changes. Instead of being trapped into controversial arguments of technological and cultural determinism we can start explaining open-ended interaction between technological system and different ways society responds to its inevitable pressure. Techno-deterministic (from McLuhan to transhumanism and even actor-network theory) approach has its value with showing how technology becomes a cause and challenge for cultural dynamics. Cultural determinism (from media-archeology to STS) demonstrates how technology is socially constructed in complex and diverse way. With the ‘ontological theatre’ we take these arguments together into the interactive world with no taught deterministic ‘cause-effect’ linear vision.

History of so called digital culture of late XX century (Gere, 2002) demonstrates how this approach can be applied to understanding of cultural dynamics of late Modern world. If we use technology as a dominant characteristic of cultural transformation (the same as we use ethnic or historical types of cultures) we can consider digital culture as a system of artifacts, interactions, institutions, mental habits and values rooted in digital coding of data. Ontological theatre of digital culture is an interactive play of values - that translate and socialize technology – and digital technology that creates new visions and opportunities. We can observe this play in current controversies of values and political tensions: information transparency vs. total surveillance (NSA type), hyperindividualism vs. virtual communality and entertainment vs. addiction. In cybernetic spirit it is never clear which competing value will win (say, old school copyright in favor of the industry or new creative commons rules). We can also observe ontological theatre of digital culture in its phenomenon such as software, personal computers and gadgets, videogames, the Internet, virtual reality, artificial intelligence, social robotics and interactive architecture.

However complexity and totality of digital culture is not a realization of cybernetics full potential and ambition (Galkin, 2013). It is interesting that so-called second order cybernetics or constructionism became very close to artificial life and complex adaptive systems approach in 1980's. In the interdisciplinary synthesis of mathematics, biology, informatics, complexity theory and philosophy cybernetics moved further to where it was intended to come – world artificial life. And as we currently observe the main technological challenge of our days is transition from digital culture to artificial life with multi-agent modeling of AI, social and personal robotics, biology inspired algorithms, genetic and tissue engineering, reprogramming stem cells and synthetic biology.

We shouldn't be surprised that this trend became mirrored in contemporary technological art avanguard, which is often called hybrid art (Bulatov ed., 2013). Among many artists we meet Stelarc who experiments with alternative anatomy of human body hybridized with technology on the biological level (ironical cyborg body). Guy Ben-Ary makes his hybrid art works as techno-biological machines with robotic body and living neurons made of iPS-reprogrammed stem cells. And again similar to cybernetic art these artistic practices anticipate next technological transformation from digital culture to the culture of artificial life.

Figure 1: Hybrid art. Guy Ben-Ary "In-Potentia" (2012, photo by Elena Ryabkoba)

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Major pitfalls affecting corporate performance in Russia

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Abstract: Improving the performance of Russian companies is one of the urgent objectives at the stage of economic globalization, the relevance of which exacerbated with Russia's entry to the WTO. The solution to this problem largely depends on the increase in the effectiveness of corporate governance in Russian companies through introduction of modern management approaches. Instead of the MBI – Management by Instructions, a management approach well established and adapted to the Russian business culture, Russian companies are trying to introduce modern conceptions. The major emphasis these new techniques is put on goal-setting and achieving results - Management by objectives (MBO)/ Management by Results (MBR), along with the innovative concept Management by values (MBV), which allows to ideal matching between interests of employees and companies' owners.

The conducted study of 132 Russian companies operating in various industries in 2011 – 2013 resulted in identifying the main difficulties and problems of modern management approaches introduction and improvement in the efficiency of corporate governance in Russia. A combination of quantitative and qualitative methods of analysis is used in the framework of this research. The results obtained in the study allowed the author to identify the main groups of problems, most of which, from our point of view, are due to the influence of the Russian cultural component. Knowledge of Russian core values and employees' cultural peculiarities helps to avoid major pitfalls in the improvement of effectiveness of corporate governance in Russia, and is of practical significance.

Keywords: Management Approach, Corporate Performance, Management by Instructions, Management by Values, Corporate Values, Culture, Russia

The global market economy places increased demands on the corporate performance. Russian companies are faced with new requirements and problems after Russia's entry into the World Trade Organization. At the time of entering only six Russian companies were included in the ranking - Top 100 as the companies with the best reputation in the world. Among them: Sberbank (27), Will – Bill-Dann Foods (37), Lukoil (68), Kamaz (71), VTB Bank (89), Gasprom (96) (*http://related.forbes.com*). These companies have leading positions in Russia due to the most exclusive ownership of natural and financial resources of Russia.

Improving the performance of other Russian companies is one of the urgent objectives at this stage of economic globalization. The solution to this problem largely depends on the increase in the effectiveness of corporate performance in Russian companies through introduction of modern management approaches. Instead of Management by Instructions (MBI), a management approach well established and adapted to the Russian business culture, Russian companies are trying to introduce modern conceptions.

The major emphasis in these new techniques is put on goal-setting and achieving results - *Management by Objectives (MBO)/ Management by Results (MBR)*, along with the innovative concept *Management by Values* (*MBV)*, which allows matching the interests of employees and a company's owners.

In the process of management concepts evolution from MBI to MBO and towards MBV we can observe the main transformation of the organizational values' set (Table 1): from quantitative production, loyalty to the company, conformity and discipline, specific for the MBI concept, to an estimation of individual results, rationalization, motivation and efficiency (MBO), and then towards orientation of employees' involvement in the process, continuous learning, creativity, mutual trust and fidelity.

Table 1 Main characteristics of management approaches MBI, MBO, and MBV

Characteristics	MBI	MBO	MBV
Scale of the strategic vision	Short-term	Medium - term	Long - term
Type of organizational structure	Multi-level pyramid	Pyramid with several levels	Networks, project teams and functional association
The need for initiative and responsibility	Low	Medium	High
Type of leader	Traditional	Focused on resource allocation	Transformational leadership
Level of staff professionalism	Performers	Staff	Professionals
Main values	Quantitative production, loyalty, conformism, discipline.	Evaluation individual results, rationalization, motivation, efficiency.	Employee participation in the process, continuous learning, creativity, trust, fidelity.

Thirty years ago the management approach that was based on values was considered as «too weak and unstable». Today it becomes a basis of the organizational strategy. Dolan, Garcia, and Richley argue that the «Management by values» concept is not only a philosophy, but a management practice as well, because this approach combines both the major values of the company, and its strategic objectives (Dolan, Garcia and Richley, Managing by Values: A Corporate Guide to Living, Being Alive, and Making a Living in the 21st Century 2006).

Having considered the theoretical part of this study we can highlight the benefits of the modern management concept «Management by values», corresponding to the best contemporary requirements for the unpredictable dynamic market, the long-term strategy, the need for effective leadership, contributing to the processes of change and the use of a high level of professionalism of the employees, their initiatives and responsibility. In this regard, we hypothesize the priority of using modern management concept "Management by values" in Russia.

A study of 132 Russian companies operating in various industries in the period 2010 to 2013 resulted in identifying the difficulties arising in the introduction of modern management approaches and efforts to improve the corporate performance in Russia.

A combination of quantitative and qualitative methods of analysis was used in this research. Quantitative analysis has been conducted through a survey of 156 top - and middle level managers of large and medium business companies (124 different companies) operating in Moscow and Moscow region from 11 different industries. The average age of respondents is 39 years. Qualitative data was collected via interviews with owners and top-managers (36 in-depth interviews), direct observation, case study methods and analysis of company legal documents.

We have found the biggest gap between desirable and existing corporate values in Russia in trust (-7), employee participation in the process (-7), creativity (-5) and appreciation of individual results (-4). These are the core values of MBV management approach, which are missing in Russian corporate culture.

Prevalence of existing corporate values in quantitative production (+6), conformism (+6), rationalization (+6) and strict discipline (+4) - all these are peculiar for the Russian corporate culture and strictly in line with the conceptual approach «Management by instructions». However, this approach was effective in the first half of the XX century and does not meet the requirements of dynamically changing environment nowadays.

Thus, the empirical part of the study revealed predominance of the conceptual approach "Management by instructions" in management practices of the Russian companies and showed preponderance of the instruction over the values in Russian companies.

The results obtained are largely explained by the peculiarities of Russian national culture, which is characterized by a high level of power distance (93) and uncertainty avoidance (95), the average prevalence of individualistic values (39) along with the level of masculinity (36) and short-term time orientation (10) by Hofstede methodology (Table 2).

Table 2 Cultural dimension score according to G. Hofstede (2013)

Country	Individualism	Power Distance	Uncertainty avoidance	Masculinity/ femininity	Long-term orientations
Russia	39	93	95	36	10
China	20	80	30	66	118
India	48	77	40	56	61
Brazil	38	69	76	49	65
USA	91	40	46	62	29
UK	89	35	35	66	25
France	71	68	86	43	40
Germany	67	35	65	66	31

Peculiarities of Russian national culture are influencing for major management processes of Russian companies, such as communication and team building, empower and leadership, problem solving & decision making, conflict resolution and negotiation as well as staff motivation.

Knowledge of Russian core values and management' cultural peculiarities helps in avoiding major pitfalls in the improvement of corporate performance in Russia, and is of practical significance.

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Cultural genes as key variable in the paths of country development: paths to establish rule-of-law of Britain, U.S., France, Russia, Germany, Japan, and China

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Abstract: In another paper submitted to a different symposium, "Multi-Level Self-Organization as A Framework to Understand Emergence of Social Institutions", I suggested that Cultural Genes, or Belief-Behavior-Codes [BBCs], are the key self-organization agents determining the actual interactions in organizational behaviors and the specific institutions being formed by those organizational behaviors. In this paper, I try to discuss how BBCs also play an important role at key strategic decision-making processes. I shall briefly review the zigzag paths from the traditional society [rule-of-king] towards modern society [rule-of-law] in Britain, France, Russia, Germany, Japan and China. Each of these paths has identifiable BBCs due to their language and traditional cultural characteristics. A comparative table is drafted and historical steering points are suggested to establish the relationship between each country's unique BBCs and the actual path it takes. I shall offer an open discussion format to invite insights and opinions from colleagues attending this symposium. The final post-conference paper will include contributions from the fellow participants.

Keywords: multi-layer, self-organization, cultural gene, belief-behavior-code, rule-of-law, constitution, Britain, France, U.S., Russia, Germany, Japan, China, Taiwan

1 Introducing cultural gene – belief-behavior-code

Biological genes passed from one generation to another, with or without mutation, are relatively stable and hard to change. Cultural genes not only pass from one generation to another vertically in families living in the same culture, but also pass from one individual – mostly youngsters – to another horizontally beyond families, through inter-personal interactions, socialization (church, schooling), education, entertainment (Disney stories, Hollywood movies, TV programs, etc.), i.e., through learning. Thus, one's cultural genes can be changed – or mutated – within one's life time. This is a number one distinction when we borrow the concept of biological gene to describe a cultural phenomenon, a distinction that some people easily miss.

A previously popular term is "meme"(Dawkins, 1989), but the concept of meme is too broad to capture the essence of my focus. A meme is the minimum unit of a transferable idea, behavior or style, carrying cultural content, like viruses that are able to pass from one to another given the right condition. Cultural genes are a subset of memes which direct one's behavior, i.e., one's true value system embedded in one's mind. I have to use the adjective "true" here since "not-true" value systems do exist, according to Argyris' Theories of Action (Argyris, 1980). "Not-true" value system equals to Argyris' "Theory Espoused" and the "true" value system equals Argyris' "Theory-in-Use." Cultural genes belong to the later, they may be overt or covert, but they are the real director sitting in the individual's driver's seat.

So what exactly is a cultural gene? It is the acting value code making decisions for a person's actions and behavior. They consists of a (sometimes hidden) logic or an operational instruction code, expressible in the format of IF x THEN y1 ELSE y2 BECAUSE z; or IF [current cognition] THEN [action 1] ELSE [action 2] BECAUSE [of internal model/theory/working hypothesis/belief]). Since it links a belief to a behavior, I named it as Belief-Behavior-Code, or BBC.

Table 1. Examples of Belief-Behavior-Codes

Case	x	y1	y2	z
Get up	Alarm clock sound	Get up	Keep sleeping	I must get up on time
Driving a car	Red light	Stop	Go ahead	I must obey traffic law
Accepting a proposal	A proposal diamond ring big enough	Say yes	Say no	I must marry someone rich enough
First Chinese official seeing a world map first time, 1584	A ridiculous map of world is gifted to us	Ask the guy to re-draw it so that we're in the center	I wish I won't have to deal so much trouble	Of course we should be on the center of all under heaven
British state guest visiting Qing emperor, 1792	A foreigner arrives to propose a relationship	Treat him a good dinner and ask him to go back	Treat him a good dinner and ask him to go back	We don't know what a relationship is
Tiananmen Square in 1989	Students demonstrate	Use force to crack down	Things are okay	Students threaten the CCP power

2 Brief review the zigzag paths from Rule-of-King towards Rule-of-Law

The change of a country from Rule-of-King to Rule-of-Law is not done over-night. In early Western history, it was common that a king might hand pick members of his council to help him in running the state, mostly for tax related public issues. Those councils were not parliaments. They evolved into parliaments, starting from 1188, by adding members elected from citizens – or those who were taxed. Figure 1 indicates the emergence and spread of parliaments from Spain to Russia, in about 400 years from 1188 to 1589. (van Zaden et. al., 2010)

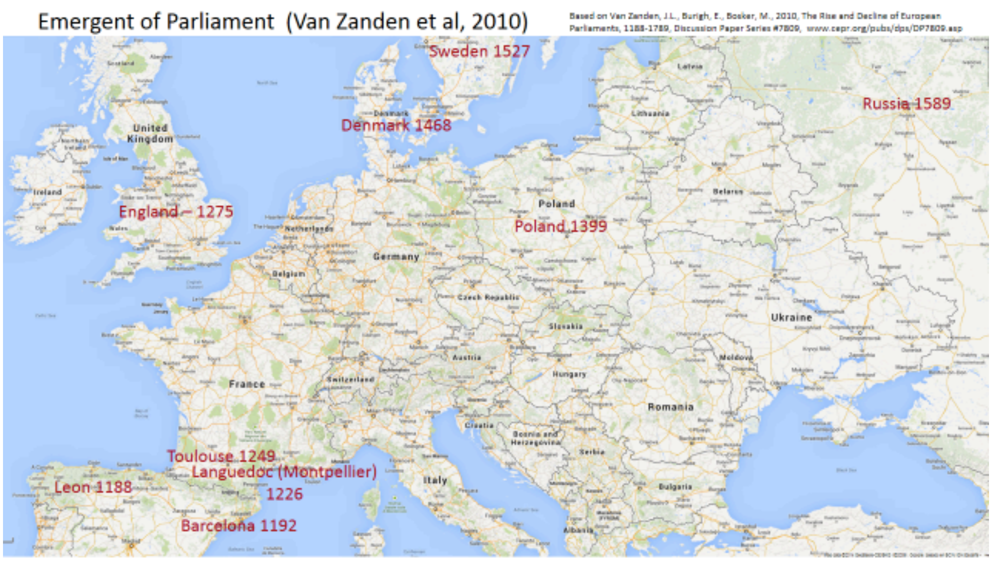

Figure 1, Emergence of Parliaments)

But parliament alone does not mean Rule-of-Law yet. The experience of having a parliament to discuss and decide important issues just set up the stage for something more important to happen later. An overall contract among the people forming the country must be formed, i.e., a constitution must be established as the foundation for all laws, thus "Rule-of-Law" becomes possible.

It is this process of how a country establishes its constitution that matters. Interestingly, different countries take different paths. Comparing them in detail would need a huge historical tome. Here I can just draw a very brief sketch, which hopefully leads to interesting findings.

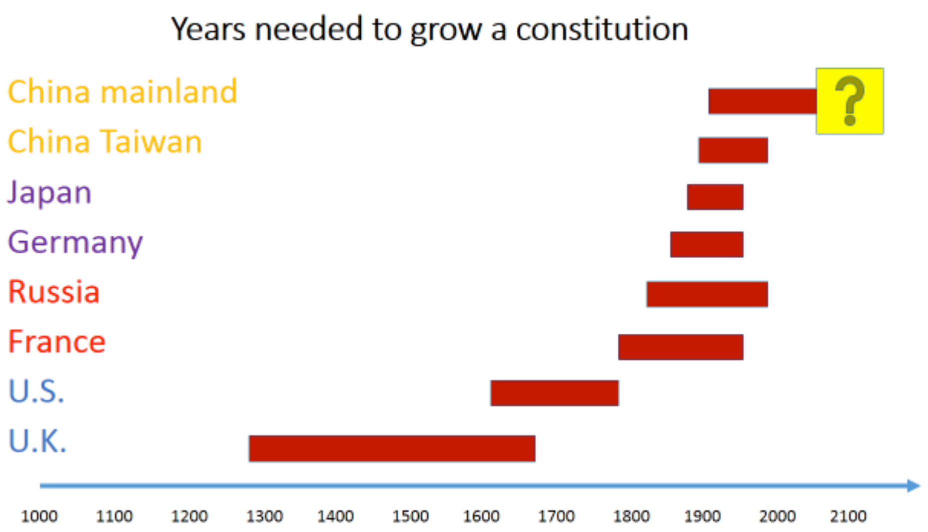

Figure 2, Years needed to grow a constitution

Country	Starting milestone event	Accomplishment milestone	Years taken	Major Thought Leaders	Core Beliefs Driving process
U.K	1295, Edward I summoned the Model Parliament to Westminster	1688, the Glorious Revolution	393	Ancient conventions, Walter Bagehot, A.V. Dicey, Erskine May, John Locke	Everyone is equal before the law, is free unless breach of law
U.S	1620, the contract on May-flower	1787, U.S. Constitution formed	167	May Flower pioneers, John Locke, Montesquieu, Edward Coke, George Washington, Benjamin Franklin, Thomas Jefferson	Consent of the governed, balance of power, civil liberties
France	1789, French Revolution, Declaration of the Rights of Man of the Citizen	1958, current constitution adopted	169	Voltaire, Rousseau, Montesquieu, Lafayette, Thomas Jefferson, Mirabeau, Charles de Gaulle, Michel Debre	Human rights, enlightenment, liberty, property, security and resistance to oppression
Russia	1825, Decembrist revolt	1993, current constitution adopted	168	Pavel Pestel, Nikita Muraviev, Prince S. P. Trubetskoy, Prince Eugene Obolensky, Herzen, Pushkin, Nekrasov, Tolstoy	Abolition of serfdom, equality before the law, learn from the West, eventually human rights
Germany	1848, Otto von Bismarck's "Realpolitik" vision, plus European Revolutions of 1848	1949, current Basic Law replaced the Weimar constitution	101	Otto von Bismarck (German Empire), Hugo Preuss (Weimar Republic + Third Reich), collective authorship for the current one	universal suffrage, Self-determination of peoples, human rights and human dignity (current one)
Japan	1868, Emperor Meiji started "restoration" movement	1947, when the Bill for Revision of the Imperial Constitution came into effect	79	Fukuzawa Yukichi, Nakamura Masanao, Ito Hirobumi, Inoue Kowashi, Kaneko Kentaro, Ito Miyoji, Iwakura Tomomi, Rudolf von Gneist, Lorenz von Stein… Douglas MacArthur	Abolition of the Han system, to boost morale, de-Asianization, learn from Germany, civil rights and liberties, democracy and renunciation of war.
China Taiwan	1898, Hundred Day's Reform undertaken by Guangxu Emperor	1991, when the Temporary Provisions abolished	93	Kang You-wei, Liang Q-ichao, Hu Shir, Sun Yat-sen, …	Three Principles of the People (Nationalism, democracy and socialism)
China mainland	1898, same as above	Not yet, only one in paper not followed	????	Same as above	Still confused as of 2014…

Table 2: Constitution Forming Process – time, duration, and driving believes (BBCs) (to be modified)

What can we observe from the above sketchy outline? Here is my first try:

- U.K. and U.S. (which are relatives anyway) are obviously pioneers, leading the whole process of building rule-of-law on this planet. Other countries started late and therefore benefited more or less through learning from U.K. and U.S. one way or another.
- France and Russia suffered huge amount of set backs, but eventually figured out their solutions by themselves. In France, it is now its Fifth Republic, so in between each republic, there were dramatic reactions or interruptions. In Russia, the seventy years of communist rule was anything but rule-of-law.
- Germany and Japan, unfortunately, had to suffer through wars, and the fate of being totally occupied by other countries, therefore got their constitutions "imported". Works well though. Ironically, Japan took the least time to accomplish the process, even through wars and total occupation by the Allies.
- The most problematic country is China. While ROC at Taiwan took about similar time as Japan and Russia to become fully rule-of-law, PRC on the mainland still does not have an effective true constitution up to today. They have one on paper only and still debate among themselves whether they need a constitutional government.

Why does the China mainland stand out as the country having greatest difficulty trying to establish rule-of-law?

A detailed look into the BBCs dominating the change processes of these countries might reveal interesting insights.

3 Identifying the Belief-Behavior-Codes in each path

Human societies have evolved from animal societies, in which violence is the main mechanism for maintaining order. The most powerful alpha individual within the pack evolved into tribe chiefs and later kings. Rule-of-King became a natural social institution in early ages, some continued to today's mafia or gangster organizations. So what is that driving force that pushed Rule-of-King institution gradually into Rule-of-Law? A detailed analysis to answer this question might need a 500-page tome. Here I can only make a quick observation based on my limited knowledge of world history. There are too many relevant stories to be mentioned even briefly here. We shall try to see only the outline of the forest, not the trees.

Histories are generated by interactive groups. Each group can be symbolized by Gordon Pask's concept of P-individual. Each P-individual consists of at least three components – its cognition (of the current situation it's facing), its value core (belief-behavioral-codes), and its strategy chosen to deal with the situation. The diversity of these three components form a three-dimension space in which we observe rich diversities, as well as different self-organizing trajectories. So is the case we're going to discuss for the eight countries here.

Figure 2 clearly shows that U.K. is the only pioneer in establishing the first model of Rule-of-Law. Even though the institutional invention of parliament emerges in Spain, quantitative research indicates that only in England the parliament Activity Index reached 100% in 18th century (van Zanden et. al., 2010). The Glorious Revolution established the right institutions for 18th century economic growth (North & Weingast, 1989). It took nearly 400 years before the "final" Rule-of-Law criterion was established as a bench mark. From a cybernetics point of view, those 400 years were a self-organizing process, driven by something in human nature that matured at that time. What was that?

Above all the possible narratives, I suggest that three basic beliefs held by various political forces including the Kings, contributed to the peaceful evolution from Rule-of-King to Rule-of-Law. They are: full respect for personal property, a higher level of rationality, and the spirit of compromise. (The path of France, on the other hand for example, did not have these three characteristics.)

The second pioneer in Figure 2 is the United States. Not like the U.K. process that was dominated by negotiations and compromise between the King and King's opponents, the U.S. process started from the question of how do our people govern themselves without a King? Leaving the rule of church and the rule of king behind, the May-flower pioneers began with the search for a social contract. Thus, freedom, equality, and check and balance of power became the major beliefs that drive the self-organizing process on the American continent.

The process in France is a sharp contrast with the above two English speaking countries. Just from the current republic named the Fifth Republic, we know there were at least four set backs in between. Was it because the French people are more emotional? I do not know. But I am sure that the spirit of compromise, rationality, and respect for property were not on the top of their belief menu. Instead, romantic beliefs of violent revolution, radical fights for rights, confrontation, and even "humanitarian" guillotines, played major roles in that social process. If we plot the French track of "Rule-of-Law" versus "Rule-of-someone" over its 169 years path, there will be an up and down oscillation clearly indicating the unique feature of the French process.

If France had a strong zigzag path, then Russia had a big circle. Nearly half of its path went astray to communism – neither Rule-of-Law nor Rule-of-King, but something like Rule-of-Mafia, although such mafias were dressed up by an ideology based on emotion, wrong understanding of economy, conspiracy and violence. Nevertheless, it was fortunate that Russia was able to produce leaders rational and humane enough to terminate the Cold War and to steer the country towards the direction of Rule-of-Law. (Since our session at this conference has a number of Russian speaking colleagues, I shall ask you to name the core beliefs in Russia's change process.)

Germany has experienced four stages in the process of our focus: German Empire (Deutsches Kaiserreich 1871-1918), Weimar Republic (Weimarer Republik 1918-1933) Drittes Reich/Grossdeutsches Reich 1933-1945), and Federal Republic of Germany (Bundersrepublik Deutschland 1945-curent). What are the unchanged beliefs through all these four stages? Patriotism, pride of race, hard work to flourish, and eventually freedom and human right, are on our radar screen.

Japan deliberately followed a "Western" model and specifically the German model in its modernization process. No other country demonstrated like Japan that a seriously backward country with limited resources could actually re-make itself to eventually win respect from all over the world, even in a hard way. After waking up in the Meiji Period (1868-1912), it established its confidence by winning a war with Qing Dynasty (1894) and another war with Russia (1904), learned colonialism from the West by occupying Taiwan (1895) and Korea (1910). Participating WWI, it fought against its former mentor Germany (on Chinese territory), and launched a large scale invasion on China and a number of Asian countries. Japan became part of WWII, under their vision of a Greater Easter Asia Co-Prosperity Sphere. All those Japanese efforts towards its own prosperity caused it to become the only country being Atom-bombed, and their own constitution was amended by Americans. Hard way, but ironically, the shortest. It only took them less than 79 years. What are the core beliefs behind this 79 years of development? Like its mentor, Germany, we can see patriotism, self-determination, sacrifice for the winning of the race, and finally absolute submission to learning from the strongest standing out.

The most problematic country on my list is China. First, it has two political bodies, ROC on Taiwan, and PRC on mainland. ROC as the legal successor of the Republic established by Sun Yat-sen from 1911 did have a true constitution, fully effective from 1991. But the Taiwan population is only 23.4 million (1.72% of mainland) and area of only 36k square kilometers (0.38% of mainland). ROC government lost in the civil war and retreated to Taiwan, so the Rule-of-Law there does mean that Chinese as a whole have earned it. The constitution-on-paper in mainland, first version written in 1954, was not able to protect the life of the President of PRC, Liu Shao-qi, who was persecuted to death in 1969. It was not able to protect the hunger-striking students in 1989 from tanks and machine guns. There is no constitutional review of cases conducted in PRC so far, nor have tens of millions of unnatural death cases been investigated. There is no real Rule-of-Law institution appearing in PRC yet. Even the concept of it is still a subject of strong debate recently.

The majority of Chinese people are still confused. That's part of the reason this paper is written. John Dewey had pointed out that the Chinese "political revolution is a failure, because it was external, formal, touching the mechanism of social action but not affecting conceptions of life, which really control society." (Dewey, J. 1921). In my words, the BBCs inside the minds of the Chinese, are still not changed, thus, they are still not able to build Rule-of-Law yet. In Figure 2 I have a big question mark there. How long will it take?

A physicist and political dissident Fang Li-zhi used to have a hypothetical figure, jokingly, 263 years (Fang, 2009). He assumed that the time needed for the Chinese to formally adopt the institution of democracy, must equal to the time they need to adopt the more advanced Western calendar system. The calendar was comprehensively introduced to China in 1629. After many fights, it officially became effective in 1913. Thus the process took 263 years. If Fang's hypothesis is true, the world needs to be prepared to deal with a China without the rule of law till the year 2161, still 147 years to go.

4 Conclusion

A comparative table should be presented here to summarize the relationship between each country's unique BBCs and the actual path it takes. But since this is only the pre-conference version, I shall leave this for discussion with colleagues, and complete it in the post-conference version.

Now, questions and comments please.

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Dr. Jason Jixuan Hu's background was cybernetics and system research in management and organizational context, with a mixed experiences in real-world human systems, i.e. various organizations. He has been conducting participatory observations, field research and experimentation about Chinese organizational behavior since 1996, after quitting a tenure track teaching position from California State University, with a belief that true knowledge can only be pursued through hands-on actions and experiences.

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Social and labor challenges and the search for an adequate response

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Under the influence of globalization and computerization of the economy, organizations are changing their structures from hierarchies to networks, resulting in the development of horizontal enterprises that operate through internet technology with multiple distributed agents. This change is bringing about a new model of social and labor relations.

The emergence of new social and labor relations is a difficult and ambiguous phenomenon. Many researchers have expressed serious concern about the fate of social and labor relations and are quite pessimistic about their future. Globalization and computerization of the economy, the rapid dissemination of knowledge, and formation of universal interdependence have led to the possibility for capital to be applied worldwide. At the same time many studies describes the deteriorating situation for workers, the atomization of individuals, individualization of labor, and the erosion of social capital. Workers' organizations, established in an era of an industrial economy, are destroyed or weaken. This violates the principle of equality of opportunity to all key players of social and labor relations to represent and protect their interests. How does the emergence of a new economy alter the social dialogue between labor and capital? Are we seeing the end of a collective consciousness among workers, amid more individualistic behavior? Are we witnessing tectonic changes in the world economy, in which concepts such as «industrial democracy», «social partnership», «social justice», and «labor rights» disappear? Is the situation so critical? And is there any way out of it?

The existing theories of social and labor relations have been developed for an industrial economy and are not effective in explaining the changes in social and labor relations caused by the globalization of the economy. Leading theorists in the field of industrial and labor relations declare that a major challenge for today's professionals, as well as their direct responsibility, is the need for renewal of ideas, policies, institutions, and industrial and labor relations practices in order to realize the fundamental mission: to improve labor efficiency, enhance equity and social justice in the economy and society. (Osterman, *et al*., 2001)

The issue of social and labor relations became the center of attention of many leading specialists in the social sciences because, as Manuel Castells (2000) notes, technological transformation and the management of labor and industrial relations in the emerging networked enterprise and around it is the main lever by which the informational paradigm and the process of globalization impact on society as a whole.

It seems to me that the way out of the puzzle which a globalizing economy creates for employees is self-organization. What model of social and labor relations countries will adopt depends not only on employers but also on employees and their ability to take advantage of the new organizational forms networked enterprise, and, ultimately, on their ability to engage in social learning and self-organization. The theoretical way out is a multidisciplinary approach to the study of social and labor relations. For the unstable, complex world of a globalizing economy the national social and labor relations systems must improve their stability and viability due to the growing complexity and instability of the global economy. A relationship between complexity and integrity is needed. Social and cultural factors largely provide this integrity. Ideas, values , beliefs, ideology, and goals – in other words the meaning of social and labor communication – that is what binds people in a society.

Fritjof Capra in his book “The Hidden Connections: A Science for Sustainable Living” (2002) describes a unified approach to understanding biological, cognitive and social phenomena, which is based on a synthesis of modern theories of living systems, including a theory of complex systems. The synthesis is based on the distinction between two perspectives on the nature of living systems, which Capra has called the “pattern perspective” and the “structure perspective”, and on their integration by means of a third perspective, the «process perspective». In more general terminology, the three perspectives on the nature of living systems correspond to the study of form (or pattern of organization), the study of content (or material structure), and the study of process. (Capra, 2002)
“When we try to extend the new understanding of life to the social domain, we immediately come up against a bewildering multitude of phenomena – rules of behavior, values, intentions, goals, strategies, designs, power relations, – that play no roles in most of the nonhuman world, but are essential to human social life”. (Capra, 2002, p. 73)

For me Capra’s conceptual approach makes it possible to create conceptual design which would be a framework for multidisciplinary studies of social and labor relations:

- Sense (meaning) might be expressed as ideas, beliefs and values;
- Form (pattern of organization) is a configuration of relationships among groups;
- Content (structure of the system) might be described as a set of interrelated variables;
- Process is social learning (on the surface – a sequence of events).

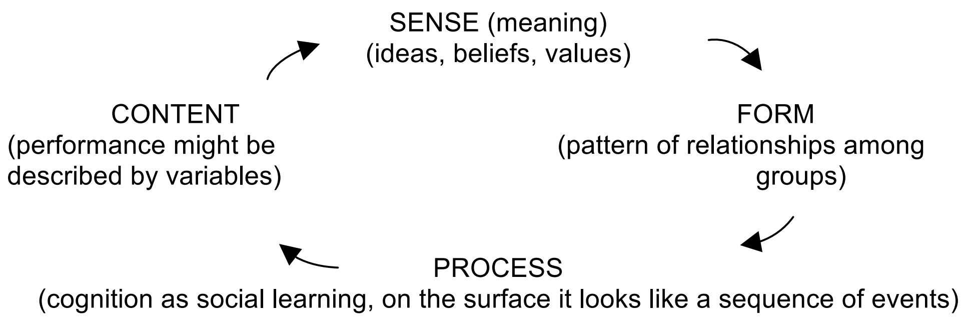

Figure 1. A model of social change using Capra’s four-sided conception and four methods for describing systems (Medvedeva & Umpleby, 2004)

Sense (meaning): Generally speaking, any system of social relations is based on a particular set of values. In a period of social and economic transformations, values, as an ethical component of social development, become important and serve as a basis for decision-making in the new situations which arise. In the ideal case, the system of social relations should be based on the set of values accepted by the participants in these relations and manifested either in the system of individual preferences or in a group morality. If these relations are manifested inconsistently or irrationally, it is reasonable to assume that the individual (or the group) has different values and/or a different type of rationality. The two sets of values are latent and declared (that is, the current system of social relations and the one to be introduced). If the normative or declared model of social relations turns out to be in conflict with the latent set of values existing in the society, an imbalance may occur, which is manifested either in the degradation of social relations or the development of society as a whole.

Form (pattern of relations among groups): In an extended system approach to social relations "communication - is not so much the transfer of information as the mutual coordination of behavior" (Maturana & Varela, 1992), which combines the aspect of simultaneous exchange - understanding information. So, “form” is a network of actors of social and labor relations, expressed in mutual coordination of behavior on the basis of exchange - understanding information , as well as in shaping the common sense (meaning) of their interaction, and achieving individual and shared goals of social and labor life.

Content: Variable “content” includes technological, economic, law aspects of social relations. In the process of interaction between social groups "content" of relations is created. Each individual, establishing relations with other actors, interacting with them, together creates the "content" of the system as a materialized embodiment of the pattern of these relationships, their forms (for example, Information Network, printed texts of laws or books on economics, labor institutions: employment contracts, job descriptions, the law on social partnership, etc.).

Process: On the one hand, “process” is the process of operation of the system of social relations, reproduction itself, evolution, reform, transformation, development, degradation of the system, and on the other hand, it is a cognitive process, a process of social learning of the participants in social and labor relations, which on the surface appears as a sequence of events. Social learning results from individual participation in social processes.

Conclusions

1. The participants in social and labor relations are now in conditions where they are forced to learn the principles of network organization and in this way to have the opportunity and responsibility to protect their interests in the new economy.
2. The tendency towards changes in the representation and protection of interests and social and labor rights are the formation of workers' organizations operating at the supranational level (for example, combining global union alliances, unions from different countries, European branch federations), expanding the functions of trade unions, the creation of new organizations that defend the rights of workers, increasing the number of participants in social and labor relations (for example, civil society organizations, tripartism - plus), the commercialization of services to protect the interests of workers (for ex., by lobbying for their interests, or designing the optimal format of labor relations for a particular project, or consulting about how to defend their rights).
3. The modern globalizing economy is characterized by instability and increasing level of complexity of social and labor relations. Under these conditions, an extended system approach, considering the system of social and labor relations as resting on natural principles of organization (networked organization, processes of self-replicating systems,

self-organization of members of labor relations, sociocultural values, development of the system as a result of social learning of its actors, etc.) introduces methodological tools, which aid us in looking at the system of social and labor relations. These tools increase flexibility, increase stability and may improve our ability to respond changes.

4. An extended systems approach sets a methodological basis for interdisciplinary study of social and labor relations and opens the way to social and labor innovations. Appling an extended systems approach in practice helps us work with social and labor relations strategically, which is extremely important in an unstable globalizing economy.

Keywords: social and labor relations, globalization, an extended systems approach.

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Intellectual development as an interaction between systems of change: a methodological aspect

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Abstract: In intellectual systems, intellect, as some kind of inner system, regulates some set of objects and processes that constitute an external system being regulated. Intellect in turn is governed by this external system, acting "in the opposite direction" like a regulator. This interaction, leading ultimately to the intellectual development, is proposed to consider from the viewpoint of methodological approach, based on the concept of system of change.

Keywords: Intellectual technology; paradigm shift; system of change; intellectual development; systems philosophy; philosophical theory of change;

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It is known that the cybernetic systems can be considered as patterns of organizations that maintain stability due to processes of change.

These processes of change are conceptualized on the basis of common idea of regulation (see, e.g., Umpleby (2013)). Particularly this idea in its various implementations remains one of the central in research of intellectual development (for example: Kuhn's concept of scientific revolutions, driven primarily by balance of puzzle-solving power based on insight). In terms of methodology, in many of these concepts it is easy to see substantial relationship to the eternal philosophical problem – the problem of change – in the form of manifestation of various variants of dualism between such fundamental properties of the world and its cognition as conservation and change. Here is a typical example of an interconnected use of concepts, each of which contains moments of conservation and change that closely intertwined:

> *"Thus, a **dynamic** composite unity … is seen by this in an environment as an entity with a **changing** niche that it specifies while it **slides** through the medium in **continuous** structural **change** with **conservation** of class **identity** and **adaptation**"* [1] *(Maturana, 1988)*

However, the content of these relationships, of their nature, the rules of their formation and consideration during the process of conceptual design commonly are not investigated and revealed by the authors specifically. And this is a great methodological problem. It is particularly acute in cases, when we turn to the study of such systems, in which variability phenomena is put in the forefront, as, for example, when considering the processes of intellectual development. This happens because ordinarily used methodology, based mainly on the account of the moments of stability, is in conflict with the necessity of all the more complete account of the moments of variability prevailing in the subject of research.

In this regard, there are at least two significant methodological tasks: 1) the need for a systemic description of processes of conservation and change; and 2) explication of the studied processes of development in terms of interacting systems, which provide change (hereinafter – system of change).

The solution of these tasks can be done on the basis of methodological approach, proposed by the author as further development of earlier discussed theses (Melnychenko, 2002) and based on the concept of the system of change (Мельниченко, 2005).

As an example, it is offered a possible solution to the problem of analysis of the dynamics of science. Any existing paradigm can be represented as a certain system of changes. The processes of regulation, acting in it, provide its relative stability, "normality" (in terms of T. Kuhn). For transition to a new paradigm, it is necessary to establish a new system of change, which is based on the elements of the old, involving them in its activity in different roles and changing them as its objects. Ultimately the new system is built over the old, replacing or blocking the disparate elements, asserting its influence on compatible ones, and forming new elements. After some period of counteraction and reconstruction the relative balance between the old and the new system is set and this is fixed as the formation of a new paradigm.

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[1] Bolding mine (O. M.); highlighted in bold terms express various interrelated manifestations of preservation processes and changes.

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Society and mental health

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Abstract: Reform of Mental Health (MH) services is being conducted in Georgia since 2011. There has been a reduction in the number of beds in large psychiatric hospitals. Some general hospitals have established acute psychiatric units, Crisis Intervention Services and a pilot program of Mobile Assertive Care Service have been created. Unfortunately, the *reform* path is partial, fragmented and inconsistent. Two years after the reform, government and the professional community started constructing the Mental Health Strategic Plan. In this context, societal attitudes toward mental health play a crucial role as public opinion could be the basis for predicting success in building new services and planning activities for reform's success.

1 Method

Societal beliefs/attitudes on mental health issues, psychiatrists and people with mental disorders were measured by a survey "Mental Health and Society." The survey contained 25 questions with multiple choice answers, concerning Mental Health issues, in general. The poll involved 250 mentally healthy adults from different social strata with the average age of 32.7 +13.8 (female - 52.7%, male - 47.3%). Only 15.3 % of responders previously had experienced brief contact with psychiatric services, some - in the process of undergraduate medical education.

Results: Measuring peoples understanding of widespread, discriminating term “Mad,” revealed that 58.9% of responders usually attribute it to the mentally disordered person, 31.3% - to eccentric person, 6.3 % - to mentally retarded and 3.5% stated, that “Mad is a person with “non-standard” or “unstable” behavior”. The majority of respondents suppose to refer to psychologists (50%) and/or to neurologist (30.5%) and/or to the priest (7.1%) in cases of mental pathology or emotional disturbances. Only 12.4% of respondents “do not shy away from a link with a psychiatrist, if necessary”. Respondents, refusing to make contact with psychiatrist, substantiate their decision in different ways. Particularly, 42% thinks – “Referral to psychiatrist is personally offensive". Meanwhile, the answer: “Society treats badly person, who is treated by the psychiatrists" had been chosen by 28.8 % of responders. Almost 45% of samples believe that there is “no protection of confidentiality of medical records” and that is caused by technical staff (32%) and psychiatrists (28%), or both. Study also discovered that there is some negative effect of a label - a certain attitude, toward psychiatrists in Georgian society. The majority of respondents agree that high IQ (61.6 %), decent behavior (58.0%), attractive appearance (6%) are essential for professional success. Regardless of above mentioned, almost 47 % think that the psychiatrists possess “some strange behavior”. 4.2% of responders consider psychiatrists to be “mentally absolutely healthy”, 32.8 % - “resistant to mental disorders”, while 2.5% think that “psychiatrists are mentally ill”. Other considerations sound as follows: "prolonged contact with patients are reflected on psychiatrists ", “they are steady and balanced," "psychiatrists are dangerous ", "they are liars”, etc. Despite expressions of sympathy toward mentally ill patients, 36% of responders believe that “it is necessary to stop the spread of mental illnesses by certain social restrictions, like prohibiting birth, etc.” Noteworthy is the fact that 32% of study-participants still believe that “Georgian psychiatrists have medications that will lead to the development of mental disorders in mentally healthy individuals”. The answer: "I do not know,” was received in 40% of surveys, while only 8% denied the existence of “such medication”.

2 Conclusions

The study data clearly indicate that attitudes of society to mental health is a constraint and is preventing people from gaining access to appropriate mental health services. Existing MH system in Georgia is still service, rather than needs oriented. It is characterised by poor quality of care and high utilization of mental hospitals; limited funding, despite having separate budget for mental health; medication oriented treatment; lack of geographical access to out-patient services, especially in rural communities; few community based services; stigma associated with mental disorders, resulting in exclusion; absence of housing and employment for persons with mental disorders; insufficient human resources; limited mental health promotion, prevention and rehabilitation, as well as advocacy activities, etc. On the other hand, MH service users have small influence on policy makers, in spite of being useful source in planning better services. Society has lack of awareness on their rights, that due to existing legislation guarantee to be treated with respect and dignity, to make own decision on parenting and family issues, etc. Thus, the biggest challenges facing the Mental Health reform in Georgia is to improve policy and practices in MH, to remove stigma on negative stereotyping MH service users and MH professionals. Moving from hospitals to the community based services, offering less restrictive, flexible and accessible care with step-by step deinstitutionalization – might be key issues for reform success. At the very first stage it's important to work with the media. Activities, like press conferences, thematic TV shows, broadcasts on radio, planned long-term educational campaigns targeted at specific audiences – are desirable to reach better results in modification of public perceptions of mental disorders and multiplying effect in stigma reducing.

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Beyond systems modelling? A proposition for integral modelling

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Abstract: The world consists of wholes and parts. The systems thinking has contributed significantly in appreciation of the wholeness and the need to model the whole in order to understand the world. On the other hand other scientific disciplines have focused on the parts and through modeling the parts tried to understand the world. However, in their existence the wholes and parts exist simultaneously, they continuously interact and dynamically co-create the world. This means that when we model the world we need to include the whole, the part, and their relations i.e. develop integral model. However, it is important to note that the world, although it exists, it is based on an individual construction and then co-constructed through different types of interactions between the individuals. Thus, in order to create an integral model, the modeling approach should provide an opportunity for inclusion of the individual construction and co-construction of the world. In this paper we propose a framework for integral modeling.

Keywords: Integral modeling; Framework; First-level; Second-level; Meta-level

1 Introduction

A model is an abstract representation of an observed system. The goal of models is to create an understanding that will enable the users of the models to make better decisions. Systems thinking has contributed significantly to appreciation of wholeness and the need to model the whole to our understanding. On the other hand other scientific disciplines have focused on the parts and through modeling the parts tried to understand specific phenomenon. However, wholes and parts exist simultaneously, they continuously interact and dynamically co-create our views of the world. This means that when we create models we need to include the whole, the part, and their relations, i.e. develop integral models.

In this paper we make a proposal for an integral modeling approach as an approach that could lead to better representations. To achieve this first, the postulated characteristics of the observed system are discussed , then an approach for integral modeling is presented. At the end, directions for further research are identified.

2 Creating understanding

The position of the authors is that before you model it, there is a needed to understand the characteristics of the world. The presence of the following characteristics are postulated: it has versions, it is not singular, it is multifaceted and multilevel, and it is continuously changing.

It is important to note that it is based on a stakeholder construction and then co-constructed through different types of interactions among the stakeholders. The following versions are identified:

- individual versions - these versions are based on an individual constructions
- artificial versions – these versions are based on algorithms
- co-constructed versions – co-constructed through different types of interactions among the individuals, between the individuals and algorithms, and between the algorithms

The world is multifaceted. Thus its versions are multifaceted. The facets are arbitrarily defined by the stakeholders through the process of construction. The stakeholders construct versions by selecting and looking for certain facets. Examples of facets are: culture, religion, technology, leadership, ecology, politics.

The world is multilevel. At least its versions are. The individual versions are the first level, the co-constructed versions are the second level, meta level versions are constructed from the second level versions. The meta level versions are not a result of real observation of the world, but a construction based on other observed versions.

The world and its versions are changing. However, the versions of the world can change even if the world is not changed. The change can be a result of introduction of new facets or new stakeholders.

3 Towards integral modeling

Integral modeling should provide options modeling the whole and part, and their relations in the same time. Furthermore, it should ensure that the postulated characteristics are embedded in the process of modeling.

This way of modeling could create an endless number of models which could limit the goal of developing models that will enable the better decision making. Thus the proposed approach needs to be modular and flexible. The identified modules are:

- Module 1: Stakeholders
- Module 2: Facets
- Module 3: Change
- Module 4: Whole-part
- Module 5: Second level modeling
- Module 6: Meta level modeling

4 Integral framework for modeling

The structure of the proposed framework is presented in Figure 1.

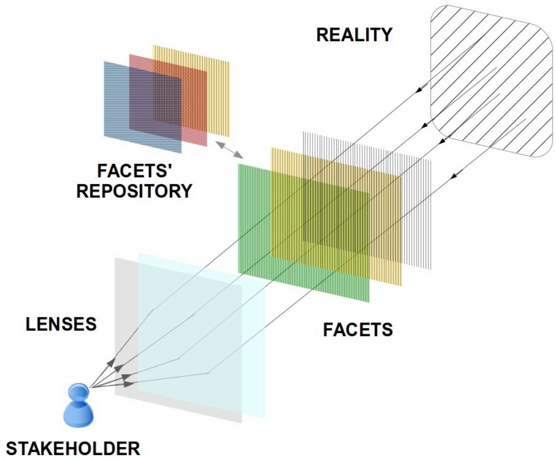

Figure 1: Modeling first-level versions

The stakeholders can be human individuals but also can be an algorithm. For example Google search engine algorithms create a version based on searched terms.

Through the introduction of the facets' repository the framework provides a flexibility the stakeholder to use different facets to look on the world.

The change and the whole-part modules are presented as lenses. The justification for this is that each facet has parts and elements and each facet is changing. The change in the facets can be shown through their development levels and part-whole relation. For example, now in modeling the world we can have the individual, organization and society developmental level on culture facet.

If we combine N stakeholders view on the world we can get second-level versions (Figure 2). This versions is based on the data that is gathered through the first-level versions.

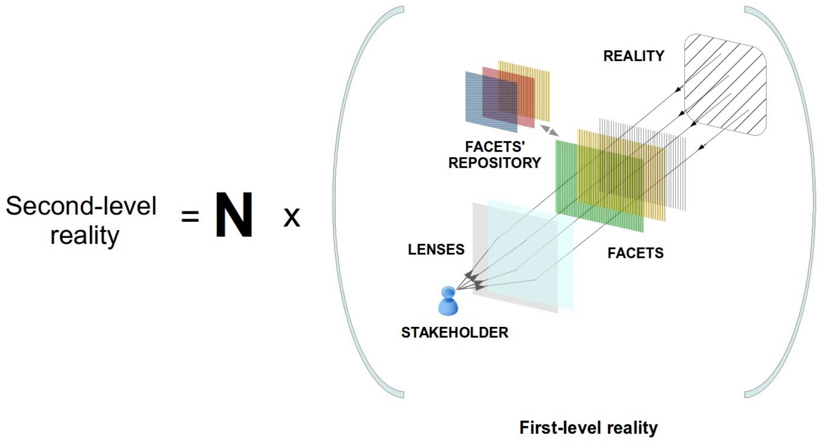

Figure 2: Modeling second-level versions

If we combine the second-level versions we can get the meta-level version. Version that is not based on first-hand data, but on second-level versions.

5 Conclusion

This framework is an attempt to make integral models. However, there are two challenges that need to be addressed so that the models that it creates are more approximate to the world.

- First, in order to create a first-order versions there is a need for the stakeholders to use the same facets.
- Second, the stakeholders need to use the same lenses.

This might create problems, especially in the creation of the second-level realities. Based on this in the future the research should focus on identification of the most appropriate facets and lens structure to be used. Also research should be done in the direction of how the human and algorithm co-create the world.

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Mijalce Santa is a teaching assistant at the Ss Cyril and Methodius Universty, Faculty of Economics – Skopje and PhD student at University Paris 1 – Pantheon – Sorbonne. His research interests are modeling of organizations, learning, knowledge, information systems, digital organizations, ontology and meta research.

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How science will be affected by an expanded conception of the philosophy of science

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Abstract: Country development requires the implementation of wise policies. Science is the principal means whereby people today decide what is a wise policy. But is our knowledge of social systems adequate to the task we have set for ourselves? Stated differently, are our assumptions about how to create knowledge in the social sciences adequate to the task of creating the knowledge we need? This paper describes how the philosophy of science has changed in recent years so that it can more successfully guide the creation of knowledge of social systems.

Keywords: First order cybernetics; Second order cybernetics; Philosophy of science, Correspondence principle, Incommensurable definitions

Beginning in the mid 1970s a group of people associated with the Biological Computer Laboratory (BCL) at the University of Illinois in Urbana-Champaign (UIUC) began an effort to make a scientific revolution within the field of cybernetics. The intent was to expand cybernetics from first order cybernetics, the cybernetics of observed systems, to second order cybernetics, the cybernetics of observing systems. Second order cybernetics meant including the observer in the domain of science. Doing so would change science from an effort to create objective knowledge to acknowledging the characteristics of the observer in the creation of scientific knowledge.

When Thomas Kuhn wrote *The Structure of Scientific Revolutions*, he said science progresses from a period of normal science (i.e., puzzle solving) to a period of revolutionary science to another period of normal science and so on. Kuhn devoted most of his book to describing the transition from normal science to revolutionary science and what happens during a revolutionary period. A revolutionary period of science is marked by "incommensurable definitions." For example, mass, length and time are fixed or not.

For the field of cybernetics the "incommensurable definitions" were the conceptions of first order cybernetics and second order cybernetics. "First order cybernetics" referred to the assumptions made by most people in the field of cybernetics. See Table 1. "Second order cybernetics" referred to the assumptions made by the group advocating an expansion of the conception of cybernetics. In the effort to make a scientific revolution the ideas in second order cybernetics were presented at meetings of the American Society for Cybernetics, the European Meetings on Cybernetics and Systems Research in Vienna, and the Dutch Systems Group in Amsterdam during the 1980s and 1990s. Symposia were organized and tutorials were conducted prior to some meetings. Through these conversations the ideas were developed further and interest in the idea of second order cybernetics gradually spread. The ideas were received with greater interest in Europe than in the U.S.

Table 1. Definitions of First and Second Order Cybernetics

Author	**First order cybernetics**	**Second order cybernetics**
Von Foerster	the cybernetics of observed systems	the cybernetics of observing systems
Pask	the purpose of a model	the purpose of a modeler
Varela	controlled systems	autonomous
Umpleby	interaction among the variables in a system	interaction between observer and observed
Umpleby	theories of social systems	theories of the interaction between ideas and society

After several years of this activity the case for second order cybernetics had been made sufficiently well so that those with an interest in the subject were persuaded. It seemed to be time to move on to a new period of normal science. How to do so? Although Kuhn said that the transition from normal science to revolutionary science was marked by "incommensurable definitions," he did not explain how a period of revolutionary science returned to a period of normal science. I think that the Correspondence Principle provides an explanation. The Correspondence Principle, formulated by Niels Bohr, says that any new theory should reduce to the old theory, to which it corresponds, for those cases in which the old theory is known to hold. That is, “incommensurable definitions” need to be reformulated in such a way that a new dimension is added, a dimension that either was not considered or was assumed to be zero. In the case of second order cybernetics the new dimension would be “amount of attention paid to the observer.”

In the past few years a second dimension has been added – “the magnitude of the effect of a theory on the phenomenon studied.” A fundamental difference between the physical and the social sciences is that in the physical sciences, when the prevailing theory changes, the phenomenon described is assumed not to change. However, in the social sciences when a theory is accepted and acted upon, society operates differently. As examples, consider the economic theories of Adam Smith, Karl Marx, John Maynard Keynes, and Milton Friedman. When these theories were acted upon, the behavior of social systems changed.

The Correspondence Principle was originally formulated to describe change in a particular scientific field. But these two dimensions – “amount of attention paid to the observer” and “the effect of a theory on the phenomenon observed” – are changes in the philosophy of science. They affect potentially all scientific fields. The philosophy of science can be thought of as a theory of how to construct scientific knowledge. If we accept this expanded conception of science, with the two additional dimensions, how would the practice of science change? This paper will suggest several possibilities.

- It is important to remember that if the two new dimensions are not thought to be important in a particular line of research, research would be conducted as it had been in the past.
- It is widely assumed that science is the same everywhere that scientific procedures, when done correctly, are done in the same way in all countries. However, scientific methods vary considerably by academic field, and there are national differences in how scientific work is evaluated. For example, Americans tend to evaluate ideas based on their practical utility, whereas Europeans are more interested in creating general theories.
- It is customary in scientific articles to begin with a literature review -- a description of previous research on the subject. However, if we assume that theories affect the phenomenon being investigated, at least in the social sciences, then we should probably also describe the effect that previous theories have had on social systems.

The paper will describe additional implications of the expanded conception of science.

About the Author

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The author is a professor in the Department of Management and Director of the Research Program in Social and Organizational Learning in the School of Business at The George Washington University. He received degrees in engineering, political science, and communications from the University of Illinois in Urbana-Champaign. Dr. Umpleby has published articles in *Science, Policy Sciences, Population and Environment, Science Communication, The Futurist, The Journal of Aesthetic Education, Simulation and Games, Business and Society Review, Telecommunications Policy, Systems Practice, Systems Research and Behavioral Science, Kybernetes,* and *Cybernetics and Systems*. He is a past president of the American Society for Cybernetics. He is Associate Editor of *Cybernetics and Systems*. He has received research grants from the National Science Foundation, the Charles F. Kettering Foundation, the Charles Stewart Mott Foundation, and the U.S. Department of State's Bureau of Educational and Cultural Affairs. He has consulted with the World Bank, with government agencies in the U.S. and Canada and with corporations in the U.S., Europe, Japan, and China. Umpleby has been a guest scholar at the Wharton School of the University of Pennsylvania, the International Institute for Applied Systems Analysis in Laxenburg, Austria, the University of Vienna, the Institute for Advanced Studies in Vienna, Austria, and the University of St. Gallen in St. Gallen, Switzerland. In spring 2004 he was a Fulbright Scholar in the Faculty of Economics, University of Sarajevo, Bosnia-Herzegovina. Between 1981 and 1988 Umpleby was the American coordinator of a series of meetings between American and Russian scientists on the foundations of cybernetics and systems theory. These meetings were supported by the Russian Academy of Sciences and the American Council of Learned Societies.

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Risks in supply chain management

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Awareness and occurrences of risk in supply chain networks or/and in supply chain management have become more acute during the last decades. Research, development and standardization for risk management in global interacting supply chain networks have acquired a significant role. The discussion of robustness in supply chain network is an ongoing discussion, especially in relation to how future supply chain network-infrastructures should be structured, centralized or decentralized. A further factor of primary interest and in some cases even vital importance is the discourse of all horizontally and vertically integrated interactions and dependencies between the different supply chain networks for providing uninterrupted services in the future. This has a direct influence on the development and the use of future smart solutions options. This symposium intends to trigger an interdisciplinary exchange of ideas by including participants with different viewpoints and experience, such as practitioners, system scientists, researchers, supply chain [network]-specialists, as well as human factors and IT specialists. We call for contributions that take an interdisciplinary, systemic view on risks in supply chain management and supply chain networks, provide solutions for some of the problems listed above and attempt to identify similarities, analogies, and differences, thereby furthering cross-disciplinary learning and application.

List of Contributors

Gerald Aschauer: Interdependencies in transport & logistics: potentials through systemic approaches

Gerhard Backfried, Katja Prinz, Johannes Göllner, Christian Meurers, Gerald Quirchmayr, Gerald Czech: Cross-media communication during crises and disasters

Romana Berariu, Christian Fikar, Manfred Gronalt, Patrick Hirsch: Natural disasters and their cascading effects: analyzing the impact on disaster relief with the system dynamics method

Thomas Benesch, Johannes Göllner, Johann Höchtl, Andreas Peer, Walter Seböck: Transversal aspects for the scenarios to support the comprehensive approach in relation to alternative futures

Eva Gatarik, Rainer Born: Towards a cooperative and knowledge-based view of decision support systems to increase the quality and efficiency in coping with risk and crisis in supply chain networks

Markus Gerschberger, Ila Manuj: Measurement models of supplier complexity

Manfred Halper, Stefan Fenz, Johannes Göllner, Gerald Quirchmayr: Evaluation criteria for cloud computing based on the upcoming European data protection regulation

Joachim Klerx, Johannes Göllner, Klaus Mak: Horizon scanning for emerging risks in supply chain systems

Lucie Langer, Johannes Göllner, Christian Meurers, Andreas Peer, Markus Kammerstetter, Thomas Bleier: Importance of risk management for the security of smart grids

Christian Meurers, Johannes Göllner, Stefan Schauer, Stefan Schiebeck, Andreas Peer, Martin Stierle: Meta risk model for critical infrastructures

Andreas Peer, Christian Fikar, Patrick Hirsch, Johannes Göllner, Manfred Gronalt, Gerald Quirchmayr: Modelling simulation-based decision support in the last mile of crisis management

Andreas Peer, Johannes Göllner, Christian Haberfellner, Herbert Bauer: Risk analysis for "Schutz 14"

Stefan Rass, Stefan Schauer, Johannes Göllner, Andreas Peer: Security strategies towards mutually dependent goals

Stefan Rotter: Modelling collaborative cyber-physical value networks as next generation supply chains

Stefan Schiebeck: An advanced risk assessment method for dependency models in critical infrastructures

Horst Treiblmaier, Wojciech Piotrowicz: Information technology and supply chain resilience: a double-edged sword

Thomas Wallner: Employee contribution to the smooth operation of interlinked production processes

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Interdependencies in transport & logistics – potentials through systemic approaches

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Abstract: The dominant position as well as the continuing growth of road freight transport within the modal split results in economical, ecological and infrastructural challenges for our economy. The field of logistics and supply chain management can provide significant contribution to overcome these challenges.

The analysis of the complex interrelationships between parameters of logistics strategies and freight transport through a systemic point of view can be a main contribution to gain new insights within these challenging problems. On the one hand scientific research should be supported through picturing and modelling the relationships through a System Dynamics approach. On the other hand, developed models should be a useful tool for evaluation and analysis of logistical as well as transport relevant parameters and their interrelationships.

The identification of parameters within logistics strategies which do have influence on transport operations have to be analyzed in more detail. Those parameters and identified relations are the elementary basis for modelling approaches. Being able to develop qualitative causal loop diagrams as well as a qualitative stock & flow models, elementary and basic relations between the two systems of logistics and freight transport can be pictured. Through the transformation of the parameters into so called “leverage points” as well as time delays included in specific models, it is possible to demonstrate that the right selection of these can help to realize both, economic and ecological improvements regarding cost reductions and reduction of harmful substances caused by transport operations. A systemic approach should be able, to picture and simulate relevant interrelationships through experiments and scenarios. Based on the breakdown and detailed explanation of the results, the most important parameters and their specific influences can be identified.

Systemic modelling enables a simplified analysis of the miscellaneous impacts within the system. This supports a more sensible comprehension of the interrelationships. First findings show that for the realization of efficient transport operations, consolidation, for example, serves as a main tool to go against cost increases as well as increasing utilization. Therefore, the “internal pressure” to consolidate has to be determined. For that task, transport flexibility acts as an important variable. The significance of a high flexibility for customers has to be clarified. The findings demonstrate that already small changes within this parameter can lead into better utilization as well as a reduction of costs. When looking at the parameter order frequencies, high efficiency potential could be found in addition. Therefore an analysis of the whole supply chain has to be conducted whether a reduction of order frequencies affects the tradeoff between less transport costs and the possibility of higher storage costs. Within this calculation not only direct costs but also indirect savings through less CO2 emissions have

to be considered. A reduction of order frequencies as well as an increase of truck load capacity highlighted an efficiency potential too. In addition, these increased truck load capacities offer new opportunities for bundling goods. As the results of the scenarios demonstrate it does not exclude modal shifts. Cost parameters which cannot be influenced by the company itself can create difficult environments for them. Within the mentioned parameters and an efficient usage challenging situations can be handled in a better way. System dynamics modelling contributes to an enhanced understanding of the interrelationships for logistics and transport decision makers within companies and supply chain networks. Further research on the developed parameters and the overall system of logistics and freight transport has to be realized within science and practice in future. A deeper understanding of this complex system can help to develop more efficient and sustainable transport flows in future.

Keywords: Logistics Strategy, Sustainable Transport, System Dynamics

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Is research professor for transport logistics at Logistikum Steyr, the logistics competence center of University of Applied Sciences Upper Austria. He finished his dissertation at the University of Natural Resources and Life Sciences Vienna in March 2013. The focus was on analyzing interdependencies between logistics strategies and freight transport through a system dynamics approach. He was also a visiting researcher at UC Berkeley in spring 2012. Currently his research focuses on Liquefied Natural Gas (LNG) as an alternative energy resource in Austria and the Danube region as well as continuing analyzing the interrelationships between logistics and mobility.

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Cross-media communication during crises and disasters

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Abstract: Traditional and social media are known to be of great benefit for crisis- and disaster communication. In this paper we argue for the combination of these different kinds of media in a cross-media, multi-media and multi-lingual approach, claiming that a combined view will yield superior results to individual media only. We emphasize the importance of analyzing cross-media links to provide valuable insights about the communication structure and -patterns occurring in different stages of a disaster. An approach implementing this combination is presented and the QuOIMA project addressing several of the issues is introduced. After describing the creation of a corpus covering several media in different languages reporting on the Central European floods of 2013, we conclude by presenting some preliminary experiments and findings.

Keywords: Multimedia, social media, natural disasters, crisis communication, knowledge development, critical infrastructure

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1 Introduction

Traditional media, such as TV, radio or print-media, have a long history of providing information about crises and disasters (C&D). Media organizations rapidly embraced the Internet as an additional channel for the distribution of information and content producing web-sites, news-feeds or online-media-archives. More recently, the same organizations have also entered the realm of social media platforms, adding yet another dimension to their portfolio of distribution channels. Whereas this diversification of media distribution was driven primarily by commercial aspects, the outcomes equally affect communication aspects during C&D. In spite of the proliferation of new distribution channels, traditional media might still provide the primary source of information for a substantial part of the population even today (depending on disaster type, language-related-, social-, technological- or geographical factors).

Recent years have witnessed a dramatic surge in coverage of C&D on social media platforms. This increase has been accompanied by the extended participation of organizations and individuals and the development and implementation of strategies on how to best combine technological advances with humanitarian and crisis-management objectives (Chan, 2013; International Federation of Red Cross and Red Crescent Societies, 2013). The benefits of using social media to gather, coordinate and disseminate information for supporting supply chains for critical infrastructure during C&D events and C&D management are widely acknowledged by experts as are potential challenges and risks (Antoniou and Ciaramicoli, 2013).

Social media, such as social networking platforms, micro-blogging or photo-sharing sites, interact with traditional media in various ways – as catalysts, sparking off initial coverage, providing different, additional and unfiltered angles or amplifying information – and together produce a broad spectrum of coverage. As examples have shown in the past, this mix of additional and complementary information can lead to substantially improved situational awareness for decision makers and planners and provide the affected public with crucial and transparent information (Kwang-Hoong and Mei-Li, 2012; Tyshchuk, Hui,, Grabowski, and Wallace, 2012).

Frequently, social media may be first to report on an event and play a time-critical role. In certain cases, they have even been found to be the only functioning communication medium (Acar and Muraki, 2011). On other occasions, professional TV stations or journalists may be the first ones to report. The exact role and relevance of media types differs from case to case and changes over time, requiring and prompting continuous research investigating the respective interplay. It is also notable that traditional and social media are increasingly being connected and inter-linked by news providers and individuals alike. Examples include professional journalists tweeting while on air, TV-programs providing links to Facebook accounts or live-discussions listing hashtags to streamline communication pertaining to their program.

Whereas much attention has been paid to the use of social media during C&D, little work has been carried out on the combination of different types of social media with each other and/or with traditional media. Incorporating the different angles and aspects should allow obtaining an even more complete, timely and diverse picture as events unfold. Clearly, the different media channels possess different qualities and advantages and their fusion should yield advantages over each individual one. Technically, this process has to be accompanied by the fusion of processing capabilities for different modalities (textual, audio and visual media) as well as multi-lingual processing. The latter is indispensable, especially in view of multi-cultural, international and cross-border C&D settings.

2 Existing work

Social media are known to have played a major role in a series of disasters (Peary, Shaw and Takeuchi, 2012). The authors of (Backfried, Göllner, Quirchmayr, Rainer, Kienast, Thallinger, Schmidt, Pfeiffer, Meurers, Peer, 2013) provide an overview and findings on how different natural disasters have been covered and investigated with regard to media utilization. Relatively little attention has been paid to the actual use and differences of language, terminology and registers in the context of social media and natural disasters: (Mendoza, Poblete, and Castillo, 2010) and (Bryden, Funk and Jansen, 2013) deal with this topic to some extent. (Vieweg, 2012) provides detailed analyses for several disasters (predominantly within the US and in English only). Potential motivations and purposes of social media use have been investigated and compiled by several studies such as (DHS, 2013) and (Peary et al., 2012). The latter also investigate how various types of media were relied upon during and following the 2011 Japan earthquake and find TV and social media to be on par.

Besides the research-projects in this area, actual use of social media for C&D management is already being practiced by an increasing number of organizations. The use of the @QPSMedia Twitter-account by the Queensland Police during the 2011 floods in Australia provides one of the first accounts of social media use for crisis communication (Bruns, Burgess, Crawford, and Shaw, 2012). The concertation of social media utilization by several US agencies during Hurricane Sandy might signal a marked shift in the use of social media in disasters (DHS, 2013). The establishment of dedicated accounts such as Twitter's @EmergencyTweets and its recent addition of Twitter Alerts point in the same direction. Crisis mapping projects and communities based on crowd-sourcing and emerging technologies, such as Ushahidi, the CrisisMappers network or Google's Crisis Map complement these activities.

3 Gaps and goals

Whereas previous research mostly focused on aspects of C&D communication within a single medium and a single channel only (typically Twitter), little work has been carried out on the investigation of cross-media communication and -patterns during such events. Consequently, individual corpora of data during incidents have been gathered for a single medium (typically a collection of tweets) and for a single language only (typically English). Subsequent processing is often limited to the same single language. On the one hand, these facts may have to do with the availability of media and the corresponding mobile input devices to the population and researchers. On the other hand, these phenomena may simply be due to technical limitations and the lack of processing capabilities for further languages. Furthermore, English has become the de facto lingua franca of social media and may be the natural choice for international participation.

Based on these observations and short-comings, we identify several key issues which merit further attention and investigation. Our interest lies in the communication and -patterns arising before, during and following a disaster involving the full spectrum of media and diversity of languages and how to best link these to allow for effective and efficient crisis management and communication. In particular, we focus on the gathering of information with the aim of providing improved situational awareness to first responders, linking identified patterns to the different phases of a disaster and to different communities.

Cross-media: both, traditional media as well as social media will continue to play fundamental and complementary roles. Their respective strengths can be capitalized on by combining sources and channels from different media, creating added value and allowing for insights not obtainable by any individual medium alone. Links between different media and their patterns during different disaster stages are expected to yield additional valuable, insights.

Multi-media: multi-media in the form of images and video is becoming more common-place with the ubiquity of portable devices. Individuals carrying such devices will often be on-site, delivering visual content and meta-data associated with short comments swiftly rather than typing lengthy texts. As a consequence, multi-media data and sites storing and accumulating them are becoming more interesting to harvest and process for analysis, interpretation and linking of content. These kinds of media require processing capabilities such as visual processing or speech recognition reaching beyond the purely textual ones often present in today’s systems.

Multi-lingual: crises and disasters often take place in multi-national, cross-border, multi-lingual and multi-cultural settings. As a consequence, media in different languages need to be collected and processed. Social media and meta-data created by the crowd can be multi-lingual and include jargon from different domains, linguistic styles and registers. These factors add additional requirements to the technologies and models involved, such as robustness to deviations from (perceived) standards. Outbound communication likewise has to take this diversity of languages and styles into consideration.

Multi-environment: the vocabulary and language-style (or register) used during C&D is likely to differ substantially across the different types of media. Specific, technical terminology and every-day language may overlap or be misused unintentionally. Messages may be phrased in different manners depending on the medium and are likely to require corresponding phrasing for outbound communication. These differences all require different kinds and levels of processing and robustness of technologies.

4 Method and experiments

The QuOIMA project addressing some of the key issues identified above was launched in November of 2012. In particular, it deals with the use of open-source information and the combination of social and traditional media in the context of natural disasters based on a specific 5-phase disaster model (Backfried, Schmidt, Quirchmayr, Rainer, Kienast, Thallinger, Göllner and Peer, 2013). In collaboration with a first-responder, the Central European Floods of 2013 were selected as the first use-case. However, further data-collection will continue throughout the project duration. Emphasis is placed on cross-media communication and -patterns occurring at different stages of a disaster. Textual processing, audio-processing and visual-processing are combined; an underlying multi-lingual ontology is employed to allow for cross-lingual processing. The architecture is based on the Sail Labs Media Mining System designed for real-time processing of open-sources which will be extended with several technologies and components. Individual components, such as the speech recognition engine are built in a way to make them re-usable in a straight-forward manner regardless of the actual version of the framework. Components, technologies and models will be extended step-by-step according to the findings obtained from analysis of the corpus. This process is envisioned to be performed multiple times, each time integrating existing insights and gathering further data resulting from these insights. The project has a duration of two years, allowing for repeated collection and extension of data-sets.

4.1 Corpus creation

To allow for the analysis of cross-media communication patterns, a parallel corpus spanning various types of media, sources and languages all pertaining to a single event is required. To this end, a corpus covering the 2013 Central European Floods on various types of media has been created. Data-sources and amounts collected are listed in Table 1. The corpus spans the period from 05/20/2013 to 06/23/2013 representing the period causing the worst floods in 500 years for some of the affected areas in Central Europe (Wikipedia). This first version of the corpus allows examining cross-media/multi-media effects. Further extensions will be addressed in the 2nd round of data collection in 2014. The final goal is to have data available in multiple-languages for all media and modalities covering an event.

Table 1:Cross Media Corpus

Medium	Amount	Comment
TV	218h	13 TV programs, 9 TV stations, 4 countries, German and English, general and specific news programs
Internet (Web)	3500	102 sources, German, English
Twitter	470k tweets	German (mostly) English and Dutch
Facebook	9800 posts / comments	posts and comments from 16 public pages, German and English, involving more than 1000 users
Press Agency	750	Press-releases, German only

4.2 Initial insights

Following the first phase of corpus collection, an initial, quantitative evaluation has been taking place, yielding the following preliminary insights:

- Floods were taking place in the South of Germany and in Austria and, with a slight delay, in the East and North of Germany. Both of these regions generate data in German which can only be distinguished by geo-location of items occurring in the text. Direct geo-location is only possible for a subset of the corpus – in line with previous findings, only about 1% of all tweets can be geo-located.
- Internet, Twitter, Facebook and TV coverage of the floods display similar behavior with peaking activity from June 2nd to June 4th and one-day delays between peaks in the order: tweets, TV, Facebook and Internet.
- Two peaks, corresponding to the floods hitting Southern Germany and Austria and – a few days later – the East of Germany, can be distinguished.

- URLs embedded in tweets do indeed link to other types of media as shown in Figure 2. These are some of the cross-media links identified as meriting further research in our work.

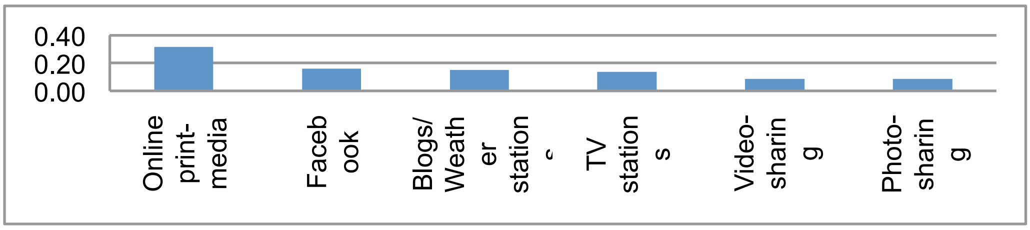

Figure 2: URLs mentioned in tweets by destination type

Downloading and processing the content of the destination documents provides further promising leads for future work employing visual processing technologies. NGOs and first-responders as well as government agencies are conspicuously absent from the set of links. This may be due to their limited participation in the social and new media field during disasters or by the simple lack of visibility of such activities.

A particular finding for Austria is that most public communication on Facebook indeed took place on a private account rather than any account associated with first responders or NGAs. More than 2/3 of all Facebook posts and comments collected were issued on this single account. Upon request by the Austrian Red Cross (personal communication), the FB page's owner refused to cooperate. This puts communication and intervention by first responders and government agencies into a new perspective (further communication on public Facebook-pages corresponded to first responders and media).

Bots may account for a large proportion of flood-related tweets. Automatic bot-detection was implemented as outlined in (Chu, Gianvecchio, Wang and Jajodia, 2012) and shows that approximately 1% of users can be classified as bots. These bots are among the most active users and account for 22% of all flood-related tweets. The type of tweets generated by bots can mostly be classified as noise but may also contain actionable information, e.g. by providing water-levels at specific locations in 15-minute intervals.

5 Conclusion and outlook

An approach based on the pillars of cross-media, multi-media and multi-lingual processing of diverse data originating from a combination of traditional and social media was motivated and outlined. The project QuOIMA is a first step in the direction of implementing aspects of this framework and establishing a parallel corpus spanning these different media types. Investigation of cross-media links has started yielding some promising preliminary results. The corpus will be extended in a second round of data-gathering, broadening its scope to further languages and extended content. Technologies and components will be integrated into an open-source information system, allowing for rapid deployment. Patterns and links to disaster phases and factors of resilience will be explored in the next phase of the project.

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Natural disasters and their cascading effects: analyzing the impact on disaster relief with the system dynamics method

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Abstract: The aim of this work is to generate further understanding of cascading effects in the context of natural disasters. Due to the complexity of disaster events, system dynamics (SD) will help decision-makers to overcome negative impacts on critical infrastructure, nature and human health by an effective disaster management. In order to develop causal-loop-diagrams (CLD) as part of the SD approach, analysis of scientific literature and journals of the selected case studies, the “European flood of 2002” and the “European heat wave of 2003”, have been conducted. Hence, knowledge of impacts on relief operations due to occurring cascading effects and their feedbacks was generated. Though the analysed events hold different characteristics, they may cause similar consequences especially concerning critical infrastructure.

Keywords: disaster management, flood event, heat event, critical infrastructure, system dynamics, causal-loop-diagram, cascading effects

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1 Cascading effects and feedbacks in the context of natural disasters

Understanding of cascading effects in the context of disaster relief logistics is necessary to manage relief operations effectively. Cascading effects refer to "a sequence of events in which each produces the circumstances necessary for the initiation of the next" (Allaby, 2004). Beside these sequences, feedbacks also occur within different affected sectors. Especially critical infrastructure is vulnerable to natural disasters. If the transport infrastructure is impacted by an event, consequences on the supply chain are possible. Limited mobility makes it difficult for emergency staff to get access to the affected areas and to supply relief goods. Other services and industries also depend on the transport infrastructure for doing their business. For example, Rest et al. (2012) show the consequences on home health care. While the number of clients will rise as a result of the disaster, nurses may be affected themselves or may not be able to get access due to the limited transport infrastructure. Blackouts caused by destructed power plants or supply lines lead to further cascades and have negative impacts on disaster relief operations. Depending on emergency power systems, using electrical equipment will be limited, what further complicates information exchange, when the communication technology is affected. Without electricity that runs the pumps at gas stations, refueling relief units can be problematic. Furthermore, decay of food is possible if cold chains are interrupted (James and James, 2010). Collision risk increases by factors as 3-5 within the first five minutes, if air traffic control is affected (Palacios and Hansmann, 2013). Similarly, nuclear power plants are vulnerable to blackouts as shown by the Fukushima Daiichi accident in 2011. An earthquake was the initial event that caused the evolvement of a tsunami, which affected the nuclear power plant (Funabashi and Kitazawa, 2012). Reactor units heated up too much caused by the loss of electricity-driven cooling capacities. In consequence, series of explosions lead to releasing radioactive steams (Tsuruda, 2013).

Literature on cascading effects in the context of natural disasters mostly focuses on modelling sequences. SD enables decision-makers to capture the complexity of disasters rather than having fragmented views. First applied by Forrester (1961), SD allows visualizing complex systems, characterized by dynamics and interdependencies. Through CLDs, a new way of feedback thinking is created (Morecroft, 2007). For illustration, we use the work of May (2007) on cascading effects resulting from flash floods. His model displays the sequences as a cascading tree, as shown in Figure 1. In this form of modelling, the illustration of interactions and feedbacks between the different consequences is missing.

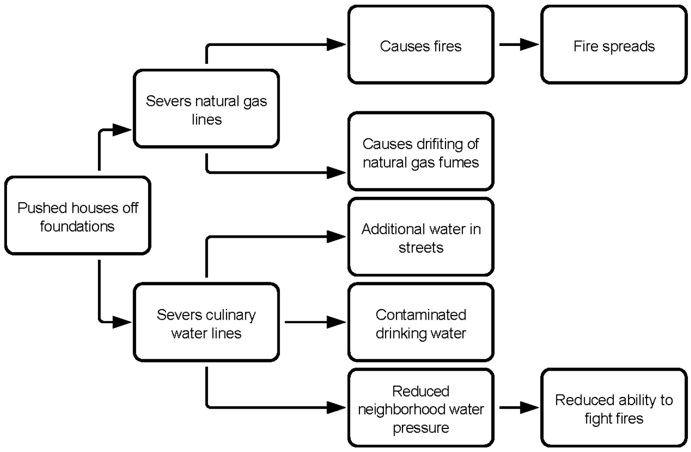

Figure 1: Illustrating cascading effects as sequences (May, 2007)

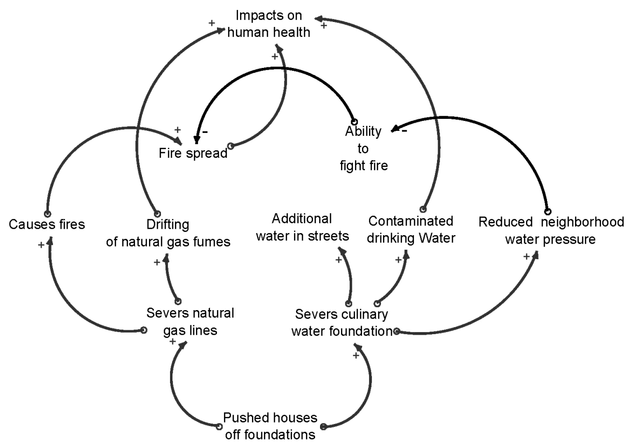

Figure 2 Illustrating cascading effects as CLD based on an example of May (2007)

Our approach in Figure 2 visualizes the sequence of Figure 1 too, but it also enables capturing interactions. For example, the lack in water pressure reduces the ability of fighting fire, which then has impacts on the fire spread. Hence, CLD allows capturing interactions and linking other thematic aspects too, as illustrated by adding human health. Fire spread or contaminated drinking water influence human health as shown in Figure 2. Another sector that could be added is for example the transportation sector, because there are also interdependencies between additional water in the streets and using these to transport commodities. Hence, the CLD enables to illustrate the complex dynamics of cascading effects in the context of disaster events.

2 Applying the SD approach

The authors generate that understanding of cascading effects in the context of disaster events by applying the SD approach. Through widespread analyses of scientific literature and articles with regard to the selected case studies, the “European flood of 2002” and the “European heat wave of 2003”, the modelling basis was set. Therefore, four areas have been considered concerning both cases: (i) the transport sector, (ii) electricity, (iii) human health and (iv) natural impacts. The analysis shows that mutual interdependencies between the different sectors exist.

Though, floods and heat waves are basically different disaster scenarios, it can be concluded that the occurring consequences and cascading effects were frequently similar. Exemplarily, these consequences are illustrated in Figure 3 focusing on the transport sector. Figure 3 refers to the consequences of the flood in 2002. For example, helicopters have been used by relief units for evacuating people and getting aerial pictures to assess the event. However, due to the increase in water levels, boats were used to get to victims in these regions (Schmidinger, 2002). SD enables decision-makers to include the lacking availability of roads in order to focus on other newly emerging options of mobility. If the availability of roads is limited, transportation possibilities of relief goods are influenced too. A higher availability of transportation possibilities leads for example to a higher availability of drinking water. Less disaster management measures have to be undertaken, if drinking water supply ensured. If more disaster management measures are conducted, fewer impacts on infrastructure will occur and the further evolvement of transportation problems will be avoided.

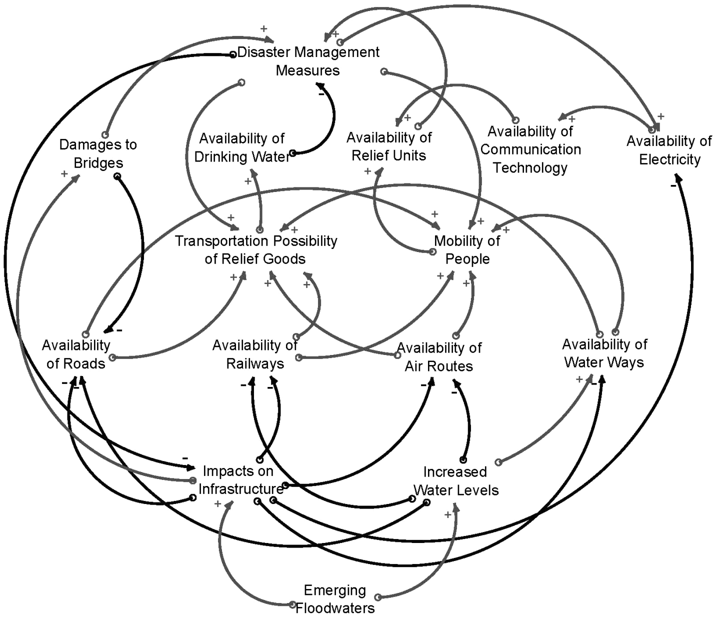

Figure 3: Consequences concerning transport infrastructure

Various impacts are often not obvious due to time delays to the initial event. Therefore, perceiving interactions that exist for example between transport sector and relief staff is essential. Transport infrastructure influences the supply chain of all commodities. For capturing the complexity of disaster events, SD is a suitable tool. This holistic consideration of SD enables further improvements in disaster management.

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Transversal aspects for the scenarios to support the comprehensive approach in relation to alternative futures

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Keywords: European security research, comprehensive approach, scenario identification, security taxonomy, transversal security aspects

1 Methodology Model

The FOCUS project (Foresight Security Scenarios – Mapping Research to a Comprehensive Approach to Exogenous EU Roles, http://www.focusproject.eu) is co-funded under the Security Research theme of the EU's 7th EU Framework Programme, for the period of April 2011 to March 2013. To realize the main contribution to develop an effective long-term prediction and assessment tool at an EU level FOCUS will design and apply an embedded scenario method to develop scenarios for security research (alternative futures) within scenarios for EU roles to respond to transversal challenges (context scenarios). The following illustration depicts the logic of the embedded scenario methodology:

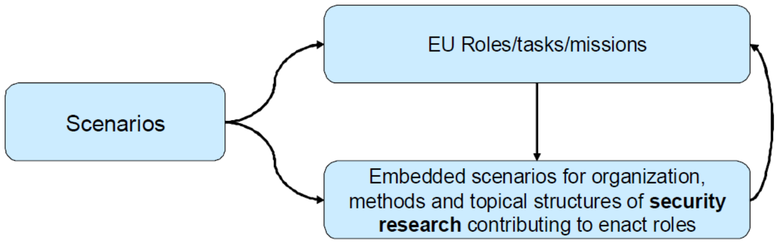

Figure 1: Methodological model

1.1 Scenario perspective

Based on a hermeneutical method an extensive literature review of European Member States security frameworks and grounded work within the security research community[1] a vertical perspective of a security scenario taxonomy has been developed:

- Global scenarios
- Local scenarios
- Drive/trend scenarios
- Defence related scenarios
- Threat scenarios

This taxonomy served as a building block for the scenario discovery process.

1.2 Scenario finding process

Scenario development was based on context scenarios. The weighing was done according to relevance from a dual perspective: (a) nation/member state vs. EU-level/international approach to civil security and security research; (b) position of the scenario on the continuum of internal/external security. The scenarios for alternative futures of security research in support of the comprehensive approach 2035 were:

1. Generalised security research system
2. Nationalisation of security research
3. Research system for European critical infrastructure protection
4. Security incident management research
5. Security economics research system
6. Public health research system

[1] Merlinger; Fry. & Hallenberg (2007) and Merlingen, Mireanu & Stavrevska (2008).

2 Guidance for possible future EU security roles

A list of cross-cutting (transversal aspects) was identified which all of the six scenarios for security research 2035 have generally in common. Those transversal aspects relate to future fields of action and needed expertise in most of the six future scenarios. In the future, it will be difficult to realise simultaneously the objectives of the EU as whole and Member States' interests. It can also be expected that EU as well as some national agencies will develop and follow their own interests and will challenge rapid collective EU actions. The following two research lines appear of particular future interest:

- Tools for policies and national views integration,
- Standards for national organisation for a comprehensive approach to security.

For the two research lines it would be necessary to elaborate

- the concept of sustainable development that may be realised under present conditions in the EU and its Member States,
- a long-term plan regarding the implementation of sustainable development concept into practice (several variants that reflect the expected conditions of the EU – to consider paradigmatic cases as well as critical and extreme conditions),
- the plan of enforcement of sustainable development principles into practice within the Member States, requiring adapted legislation, financing and qualified management in all aspects.

Further transversal aspects affecting the identified six major EU security roles have to be identified. Multiple scenarios based on IT-supported foresight in the form of alternative futures that are plausibility-probed and not just threat scenarios, for support of security research for exogenous EU security missions, have to be developed. The increased complexity of security research will amplify the importance of identified transversal security aspects, rendering security research an even more interdisciplinary field of research.

FOCUS is co-funded by the European Commission under the 7th Framework Program, theme "security", call FP7-SEC-2010-1, work program topic 6.3-2 "Fore sighting the contribution of security research to meet the future EU roles"

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Towards a cooperative and knowledge-based view of decision support systems to increase the quality and efficiency in coping with risk and crisis in supply chain networks

"If the solution is the problem..."
(Paul Watzlawick)

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Abstract: Unexpected critical situations or even disasters are multifaceted and their occurrence is increasing. They produce complex situations which require coordinated actions of various organizations to reduce damages and to support affected people efficiently. Whereas standard decision support systems focus primarily on the development of an ingenious toolkit, the necessary knowledge development of its users happens uncoordinated and just by chance. We therefore focus on the development of an integrated information system which provides status reports as well as information from simulated scenarios and an analysis of past and future developments and combines them with building up shared meaning and mutual understanding as a basis for establishing and developing a common terminology among multiple actors in rescue operations. This should help to improve the coordination of responses to exceptional situations and to provide faster and more efficient support to affected people by way of a better coordination and cooperation among all organizations and people concerned with the handling of those situations.

Keywords: Decision support systems; Knowledge development; Risk; Crisis; Creativity; Reflection; Expertise; Cooperation; Innovation; Flexibility; Sharing Expertise; Knowledge Management; Supply Chain Management; Complexity; Organizational Epistemology; Systems Theory; Model Theory

Acknowledgement: This enhanced abstract (with respect to our original work) would not have come into existence had it not been for knowledge and support of the other partners of the project LMK-MUSE (11.2013-10.2015) funded by the Austrian Research Promotion Agency (FFG). They all have been doing a splendid job in developing the innovative approach described and reflected below in order to cope with "butterfly effects" successfully.

1 Setting up the scene in relation to the Last-Mile problem area

Unexpected critical situations or even disasters are multifaceted and their occurrence is increasing every year. They produce complex situations that require coordinated actions of various organizations to reduce damages and to support affected people efficiently. For example, in cases of the so called "last-mile" distribution, where basic goods (e.g., food) and services have to be transported to the location of an accident by the cooperation of private and public/military organizations, is due to damaged infrastructures and limited resources especially challenging. Due to the involvement of multiple actors in the rescue operations, where each differ in their missions and goals, coordination, however, is difficult to achieve. As both the promptness and efficiency of decision-making and acting are crucial in complex disaster situations, a close cooperation between private and public organizations based on shared meaning, information and knowledge/experience is necessary. The majority of current decision support systems in disaster management focus only on a specific subdomain or sub-organization; an integrated consideration of all essential factors and actors is rather rare. Thus, there is a great need for both research and action to facilitate a mutual understanding of relevant processes and to develop a complex support system to optimize both decision-making and the sharing of resources.

2 Managing a distributed knowledge and resource system: A model-theoretical systemic approach to Supply Chain Management

2.1 Outline of an innovative way of coordinating forms of knowledge and forms of life in distributed knowledge and resource systems

By building up shared experience **E** among all actors with a different kind of background knowledge **H** = {E, F, K, M} (cf. also the approach of Institutional Logics by Thornton et al., 2013, with respect to handling organizations efficiently) in, for example, rescue operations, a common terminology **K** can be provided to enable a better coordination and cooperation. Shared meaning/experience **E** is the basis for corrective acting P → Q (cf. also Weick & Sutcliffe, 2001) based upon the results produced/calculated (S → R) by the powerful cloud-based simulation and operations research toolkit **K** which will be developed as a part of a complex decision support and knowledge system. In other words, the decisions-makers will be supported by a meaningful processing of data and a detailed overview of the current situation in real-time and in a three-dimensional way, based on topographic features and additional external factors. Shared experience based upon dialog in the sense of Bohm (1998) will allow them to correct their action.

Additionally, different scenarios can be simulated by an integrated agent-based simulation with the toolkit in question. Better knowledge about potential developments can counter and improve rescue operations. By providing real-time information of all the available resources and their current state in a common database to various actors, efficiency can be further improved.

2.2 A meta-theoretical systemic framework for the analysis and the development of distributed knowledge and resource systems and the coordination of action

In Figure 1 we can see that the supply chain can/should correspond to the line of action from some problem P (the need for distributing some goods/services or even information or perhaps knowledge, although the latter cannot be provided directly) to the solution Q, i.e., successful transport/supply of some goods/services to its destination.

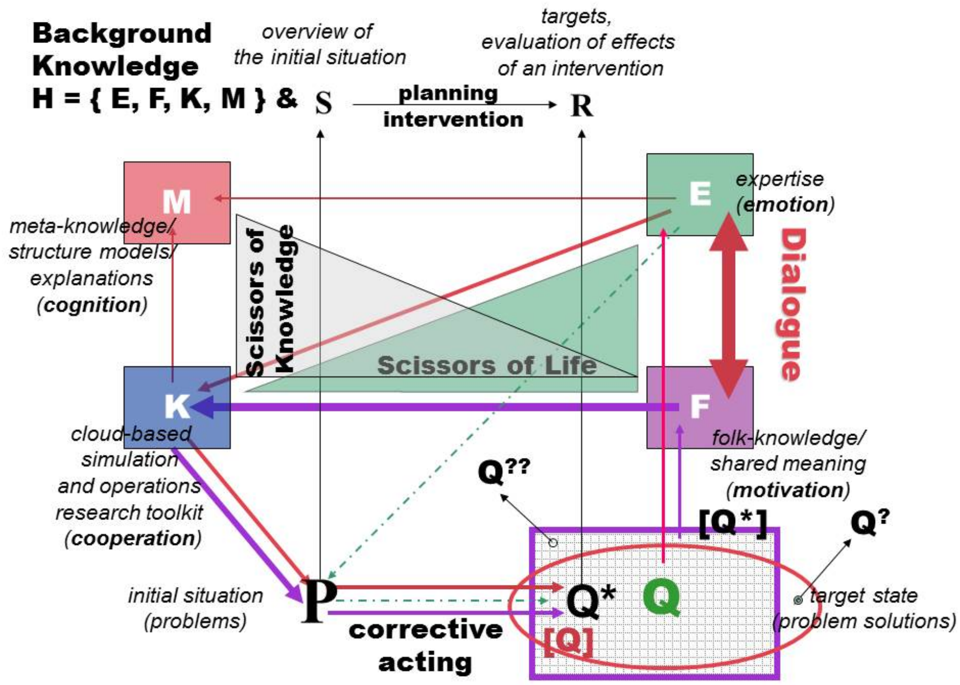

Figure 1: LIR (Language-Information-Reality) with the Scissors of Knowledge and Life

To solve such a problem in an optimal way can be sometimes fairly trivial but sometimes (e.g., when the line of transport is broken) very difficult. Conveying knowledge, for example, is not identical with handing in a book at its destination: Sometimes we need examples or rules **K** for the application (e.g., a plan), and sometimes we need information about the person being addressed and how to express certain information so that it can be understood. Thus, we do not consider a supply chain by simply looking at the bearer of information because sometimes “success” cannot be identified with what we just see. If we supply some important information about a thunderstorm or some flood approaching us, it may be that we have to consider what can be understood and also in which way an addressee will react. So, in some cases when the supply of goods and/or services is nothing really physical, it can be difficult to check and understand how we might achieve our aim.

At the first sight, these still are so called “limiting” or “borderline cases”. But it sheds some light upon the easy case as well, i.e., when we want to provide (supply) physical goods and/or services and need some information, for example, about the situation of transport. We still have to think about the reception of the information and how it can be used to achieve a simple aim.

On the one hand we have to consider (1) the idea that we need communication and cooperation, and on the other (2) the reactions of the people with their cultural, professional and personal background and (3) the persuasive power of arguments for taking action and appropriate measures.

What we need in this context is visualization and intuition at the top level in Figure 2, i.e. when we consider our information and draw conclusions of how to get on with the "maps" (literally and in a metaphorical sense) we are using. The problem is the selection of measures of actions according to our analysis of the situation but also the way in which "decision-makers" have to argue for or against actions and measures to be taken.

Thus, if we just look for one solution to get, for example, some goods/services to people who are in need of them and if the usual means of transportation are blocked, we will find it necessary to consider different means of transportation. But if we are in need of such means, it may also be important to know that some item is available somewhere else, and we can get that information in due time. The problem however is whether all the important information can be described (in words) and be put into a database. In this case we need knowledge beforehand and how to construct an adequate picture out of the data and interpret them in the right way. We need a lot of experience **E**. We need some preconception about what we will need for a solution (we need to know what to look for) and will consider only this relevant information (if it is stored) to be taken into account. We store what we think is essential – though sometimes we could find some other information and then some other solutions. We must not look for solutions only within a pre-given realm of information: We are still in need of creativity and innovation.

Furthermore, we also have to consider the fact that people need to feel secure as a presupposition of their cooperation. People must understand what is going on and most of all to be "calm". If they are nervous, things may go wrong. In this case information has a different task to fulfill: It is not just concerned with technical solutions (local optimizations) but also with keeping people reasonable (and distanced, and thus calm). They need to be cooperative and not just behaving like silly defectors in the prisoner's dilemma. These are pictures and scenes which are not directly addressed in the supply chain management but nevertheless may play an essential role in producing/providing sustainable success of measures applied in its context.

Security in decisions for measures to be taken is essential but does not just depend upon the technical solution alone – this is also our problem.

We have to consider the "background knowledge" (the ideology, the culture, the epistemic resolution level) of the decision-makers in providing and processing information. They rest their decision upon their knowledge! On the other hand we need to be open minded, if we need special help to enrich and enhance the background-knowledge, and that again is the topic of the model-theoretical systemic framework of analysis and development LIR concerning the relation between language information and reality because we want to find out what it is that is possible to be conveyed in language or with other means of communication. The problem is that not all information can be reduced onto such a simple scale that we do not have to consider the underlying meaning or the simplifications that went into the representation of information/knowledge.

We want to stress that sometimes it is important to understand how certain kinds of information or even knowledge "came about" to understand the limits of their application. The scheme LIR can sharpen the eye for just that idea, i.e. to understand what kind of simplifying assumptions are underlying our models.

What should we do when we need to be open for a change of action or a correction? Perhaps one point is sometimes forgotten with respect to simulations and the algorithms that are underlying them. We first have to have a practical idea to solve some problem and afterwards we can find computer programs to produce, well, actually the values which we think are essential. But the point is that these values are not literally descriptive. Our algorithms need to correlate with actions! And these have to be interpreted.

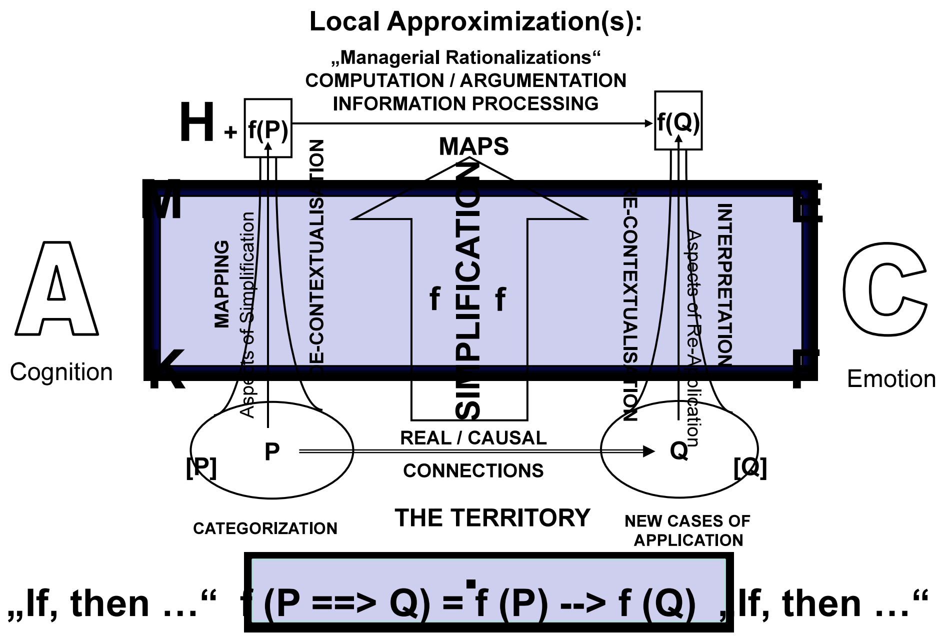

Figure 2: "The map is not the territory!" (Gregory Bateson)

Summing up, the model-theoretical systemic framework of analysis LIR (Language-Information-Reality) firstly published in Born (1982) can be used for the analysis and evaluation of the acceptance of (1) effects of an intervention (results), (2) interventions (measures) to provide acceptable results, and especially of (3) „explanations" of the success or failure (of the measures applied). Further, it can be used for (4) technology impact evaluation, (5) identification and development of knowledge for dealing with unexpected situations and last but not least for (6) a systematic development of understanding and cooperation (private and public partnership) between private and public/military organizations for coordinated action.

3 Discussion and conclusions: Overcoming the temptations of the Information Society by cooperation

Figure 3 (since a figure can tell more than 1000 words) summarizes our reflections and combines it with the work of Martin Nowak (with Highfield, 2011) where humans have the chance to be super-cooperators and where he describes five mechanics of cooperation to overcome the so called prisoner's dilemma and the "tragedy of the commons" (Hardin, 1968).

These mechanisms are (1) repetition (direct reciprocity), (2) reputation (indirect reciprocity), (3) spatial selection, (4) multilevel selection, and (5) kin selection.

It is essential to consider how new opportunities to cooperate are able to drive creativity! Thus, let us provide a shortcut of the mechanisms of cooperation (we put the corresponding knowledge-components/fields and knowledge-roles in LIR in brackets):

1. Repetition (first simple rule): [K]
"I shall scratch your back and you shall scratch mine" – Nowak there describes how direct reciprocity can lead to the evolution of cooperation but only if the probability of an encounter between the same two individuals exceeds the cost-to-benefit ratio of the altruistic act.

2. Reputation (second rule): [E]
This mechanism of cooperation thrives when there are repeated encounters within a group of players. Indirect reciprocity can only promote cooperation, if the probability of knowing someones reputation exceeds the cost-to-benefit ratio of the altruistic act.

3. Spatial selection: [core / knowledge as a systemic relation]
This process occurs on the chessboard of life or in the spider's web of social networks or the myriad sets that we all belong to. Cooperators can prevail by forming networks and clusters in which they help each other. The benefit-to-cost ratio must exceed the average number of neighbors per individual.

4. Multilevel selection: [M]
This mechanism recognizes how, in some circumstances, selection acts not only on individuals but also on groups. – This cooperative mechanism works well if there are many small groups and not so well if there are a few large groups = 4^{th} rule.

5. Kin selection: [F]
Here the bonds of family and common ancestry are decisive. The coefficient of relatedness must exceed the cost-to-benefit ratio of the altruistic act.

The point of these correspondences is that we have to consider how and when we agree to use information appropriately and feel to be persuaded/compelled by an argument that should help us not only to decide about an action but to be able to accept and act correctively (to prevent mistakes), innovatively and sometimes even creatively.

We should like to end with two quotes from Martin Nowak (with Highfield, 2011) which well fit into our topic:

> *"The story of humanity is one that rests on the never ending creative tension between the dark pursuit of selfish short term interests and the shining example of striving toward collective long-term goals. I believe we now understand how defection in the prisoner's dilemma can be trumped by cooperation. ... Cooperation puts a more optimistic sheen on life than the traditional take on Darwin, which condemns all life to a protracted and bloody struggle for survival and reproduction. Mutation and natural selection are not enough in themselves to understand life. You need cooperation too. Cooperation was the principle architect of 4 billion years of evolution. Cooperation built the first bacterial cells, then higher cells, then complex multicellular life and insect super organisms. Finally cooperation constructed humanity." (p. 280).*
>
> *"We need to place more faith in citizens than in leaders."* (p. 282).

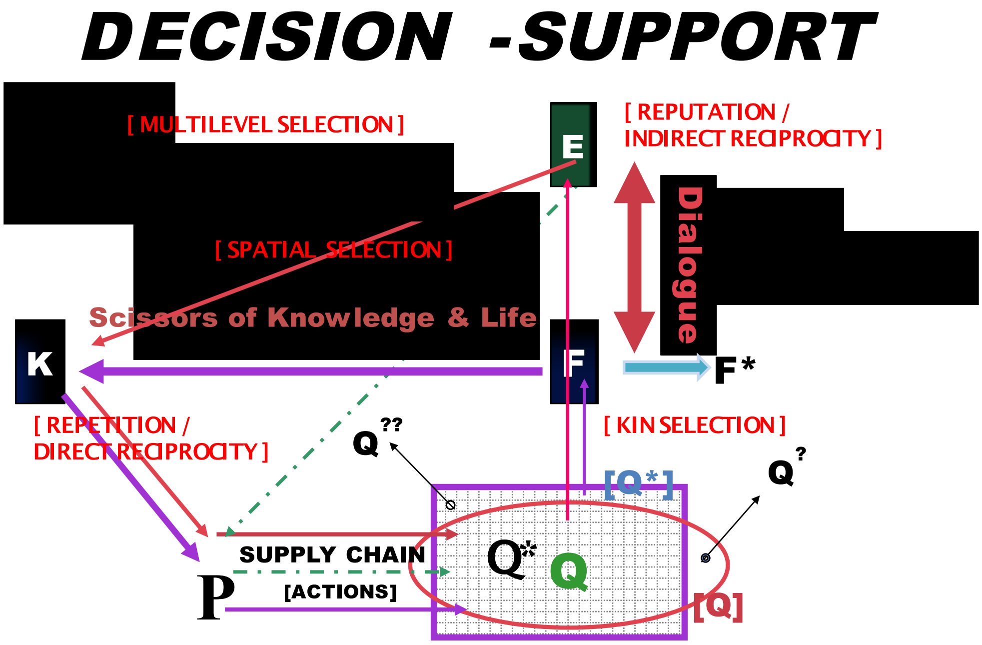

Figure 3: Reflecting Nowak's approach (mechanisms of cooperation) in the scheme LIR

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Developing and testing theoretical and measurement models of supplier complexity

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Abstract: Purpose of this paper is to advance the theory of SCC in the specific context of supplier complexity because supplier complexity has increased tremendously with increasing globalization. Specific objectives of this research with respect to the gaps in the literature are: (a) to develop a theoretical model of supplier complexity that includes both objective and perceived components; and (b) to develop and test a scale that is theoretically robust and managerially useful for measuring supplier complexity.

Keywords: Supply chain complexity, supplier complexity

Acknowledgement: The approach presented in the paper is part of the collaborative research project FP7-People-2013-IIF Supply Chain Complexity (No. 628423) and the authors would like to thank all partners for their contribution.

Purpose

Supply chains become increasingly complex as product life cycles shorten, product variety and customization increases, customers become more demanding, and supply chain constituents get more geographically dispersed (Manuj and Sahin, 2011). Wilding (1998), one of the first researchers to investigate Supply Chain Complexity (SCC), proposed a SCC triangle, comprised of deterministic chaos, parallel interactions, and amplifications. Vachon and Klassen (2002) offered a multi-dimensional conceptualization of SCC comprising of the levels of complicatedness and uncertainty. Choi et al. (2001) suggested that supply chains are “complex adaptive system”. Bozarth et al. (2009) provide a definition and empirical test of SCC using survey research. Manuj and Sahin (2011) developed a model of SCC using qualitative research.

Companies need to learn to rapidly manage an increased level of complexity to remain competitive (Lewis and Sheinfeld, 2006). SCC negatively influences delivery times, operational costs, transaction costs, and supplier responsiveness (Perona and Miragliotta, 2004; Choi and Krause, 2006; Wu et al., 2007). Companies that are able to manage SCC make up to 73 % more profit (Deloitte, 2003).

A review of literature reveals several gaps in the body of knowledge. First, theoretical conceptualizations of SCC are inadequate in capturing the multi-faceted dimensions of the construct (Hofer and Knemeyer, 2009). Moreover, several dimensions of SCC such as supply-side or demand-side complexity have not been investigated in isolation. Second, there is limited research on how to measure SCC (Hofer and Knemeyer, 2009; Closs et al. 2008) or the components of SCC. Third, the sparse empirical research on SCC is limited in its ability to provide theoretical generalizability (Manuj and Sahin, 2009) or managerial guidance (Closs et al., 2008). Fourth, there is preliminary evidence that, in addition to the objective complexity, perceived complexity also affects supply chain outcomes. However, no research so far has examined these distinctions.

The purpose of this paper is to advance the theory of SCC in the specific context of supplier complexity because supplier complexity has increased tremendously with increasing globalization. Supplier-related activities could account for up to 60% of the cost of goods sold and are critical to several customer service dimensions. The specific objectives of this research with respect to the gaps in the literature are: (a) to develop a theoretical model of supplier complexity that includes both objective and perceived components; and (b) to develop and test a scale that is theoretically robust and managerially useful for measuring supplier complexity. A working model is presented in Figure 1.

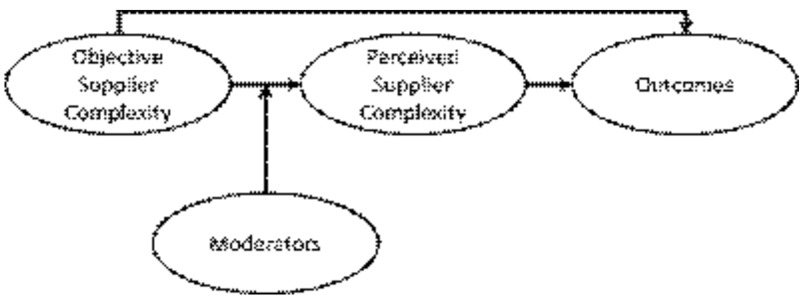

Figure 1: A model of supplier complexity

Design/Methodology/Approach

An extensive literature review is underway to establish the components and outcomes of supplier complexity. We are building upon existing research and scales (Manuj and Sahin 2011; Bozarth et al. 2009) to develop a comprehensive theoretical model of actual and perceived supplier complexity. A convenience sample of companies from Austria will be used to refine and purify the scale and theoretical model, and a broader sample will be used to test the theoretical model.

Findings

We expect to: (a) delineate the components of supplier complexity; (b) establish theoretical relationships between and provide empirical support for objective and perceived components of supplier complexity; (c) establish relationships between supplier complexity and performance outcomes; and (d) develop a scale that managers can employ to measure and manage supplier complexity.

Relevance/Contribution

This research contributes to advance the theory of SCC in several ways. First, this research expands the existing body of knowledge by investigating the specific components of inbound supply chain complexity. Second, it closely examines the link between perceived and objective supply chain complexity. Third, it develops and tests a scale to understand the theoretical linkages between components of complexity and supply chain outcomes. Finally, from a managerial standpoint, it provides a useful scale to measure supplier complexity and its effect on performance.

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Evaluation criteria for cloud computing based on the upcoming European data protection regulation

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Abstract: The European Union released a proposal on the protection on individuals with regard to the processing of personal data and the free movement of such data. One goal of the Data protection Regulation is to form the statutory framework to facilitate the adoption of cloud technology by Small and Medium Enterprises and mitigate the risks stemming from introducing Cloud Computing Service Providers (CCSP) into their supply chain networks. The developed evaluation criteria stemming from the Regulation should help SMEs to assess CCSPs for compliance and their capability of handling modern security and privacy objectives.

Keywords: General Data Protection Regulation; Small and Medium Enterprises; Cloud, Security

1 Introduction

Today cloud computing technology and its various fields of application have reached a momentum and like every other, rather young technology service, the adoption and integration of cloud computing in the existing supply chains faces different problems and risks for small and medium-sized businesses. The European Union has identified cloud computing as a major future technology in the Information- and Communications Technology (ICT) sector and aims at enabling the economy to faster adopt and facilitate cloud computing through all sectors. The utmost important regulation for this cause is the upcoming European Data protection Regulation, as for the moment only available as an evolved proposal.

Information has become one of our utmost important resources in most industry branches, data has become a very liquid good that can easily be transported across sites, cities and borders and this generates a complete new challenge for SME's using or providing cloud computing services. The motivation is to distil evaluation criteria out of the regulation and security guidelines from the European Union to create a framework for SMEs that help them adopting cloud computing in their IT assets in a secure way.

2 Results

The first step in the assessment of a CCSP is to identify who holds which role. Regarding the Regulation there are the roles of controller, processor and the joint controller. Each role has its own set of rights and duties therefore the SME has to identify the role of every partner in the supply chain and evaluate their level of compliance in accordance to their role.

The key component of any cloud service nearly always revolves around data. The Regulation gives insight on the different classes of data and how to evaluate the CCSP regarding his implementation of security and organizational measures to protect this data. Especially personal data – any information relating to the data subject – and sensitive data have to be protected to prevent unlawful use.

Another criterion is given by the need of documentation due to the heavy impact on security. Documentation is important to demonstrate results that originate from selected security measures or controls and makes decisions traceable. In combination with the necessary authorization from the supervisory authority prior to the use of personal data and a detailed data impact assessment the Regulation establishes traceability in the relationship between SME and CCSP.

Every venture working with the personal data of data subjects (an identified natural person or a natural person who can be identified) has to establish procedures that enable the data subject to exercise his/her rights. Due to the new data centric business models the Regulation identifies the collection of personal data as a field that is in need of adjustment and therefore demands the provision of possibilities of rectification, erasure, access and objection for the data subject.

The Regulation also introduces the data protection officer that has to be established by every corporation that employs 250 people or more, that is a public authority or body, or if his core activity requires regular and systematic monitoring of data subjects. The data inspection officer has to be involved in all issues related to the protection of personal data and is responsible to keep the SME informed regarding his obligations to the regulation.

The regulation describes very precisely the circumstances under which data can be lawfully transferred to a third country or an international organization for further processing purposes and thereby reacts to the current uncontrolled cross border flow of data. It states four core scenarios that help to evaluate if a data transfer anywhere in the supply chain is legally.
Another criterion is the encouragement of codes of conduct that include commitments to fair and transparent data processing and to the lawful collection of data and a certification scheme that proves the proper application of the Regulation by the SME or CCSP. The development of certificates, certification mechanism, data protection seals and marks will help elevating the possibilities of the SME, to assess the level of data protection and compliance provided by the CCSP.
The European Union is well aware that especially the adoption of cloud technology by SMEs is a critical success factor to enable the cloud to reach its full potential and therefore has identified cloud-specific Key Actions in the Europe 2020 plan. One action is to cut through the jungle of standards by identifying and counteracting typical risks and challenges like the Availability of services and data, the current lack of data classification mechanism, integrity issues, confidentiality concerns, regulatory compliance, reputability, lack of forensic readiness, loss of control, responsibility ambiguity, lack of liability, migration problems and lock-in.
Since cloud services have special requirements regarding security and privacy objectives the European Union Agency for Network and Information Security developed a guideline that aims beyond the traditional IT infrastructure and security requirements and developed standards that elevate security and privacy objectives that are regarded major in the field of cloud computing, this includes protection of data from unauthorized access, disclosure and modification, the insurance of isolation, service availability, appropriate security provisions for cloud applications, security of connections and networks, enforcement of privacy policies and incident prevention, detection and response.
Every listed criterion can be used by the SME to assess current or future cloud service providers in his supply chain. The criteria focus on the view of the European Union well aware that there are several nongovernmental guidelines in the field of secure cloud computing.

3 Conclusion

There is a major need of regulation in the information market and SMEs are waiting for the upcoming Regulation to align their business strategy appropriately. Nonetheless a firm and solid security strategy pose as a competitive advantage in the fast developing cloud service market. It is beyond all questions that a SME sooner or later has to add cloud services to its infrastructure to stay competitive but the SME can choose how he integrates this technology in his business model and thereby influences if it will be successful or end in disaster. Not every criterion applies to any scenario; the SME has to verify where the criterions are applicable and if they are enforce them. The aggregation of evaluation criteria stemming from the Regulation also helps cloud service providers by identifying criteria that are applicable to their business model and giving them a competitive edge by implementing the regulatory criterions and thereby facilitating compliance, strengthen security and boosting customer confidence. Since the Regulation is still in progress the final version may change some details of the here presented criteria.

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Horizon Scanning for emerging risks in supply chain systems

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Abstract: Existing foresights studies produce expectations about mid-term and long-term trends. These expectations tend to change accidently, caused by external disruptive events. For reliable long-term strategic planning it is necessary to understand the dynamics of these changes. Our horizon scanning method is developed to address social needs, as well as scientific capabilities and technical solutions and will produce reliable knowledge about weak signals for threats, disruptive events and long-term trends. The goal of this extended abstract is, to present a consistent horizon scanning method, developed in the security domain, to deal with expectations about future trends in a rational manner. Rational in this context means that the expectations are formed, based on evidence

Keywords: Horizon scanning, foresight, strategic long term planning, research agenda setting, critical infrastructure, supply chain protection, cyber security

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Transparent, public knowledge about long-term trends is very important for the efficiency of each strategic long term planning activity in all supply chain networks. Each stakeholder has their own expectations about future trends and behaves in accordance to these expectations. Misleading expectations can cause flawed investments and political strategies. To have reliable information about future social needs and possible technological solutions is a win-win situation for all stakeholders of each supply chain system. However traditionally each stakeholder tends to produce his own knowledge is often has no intention to share his knowledge. We will present a method for automatic knowledge creation and sharing to increase the public knowledge in the system.

1 Methodical concept

Knowledge about future developments, about future social needs, about future research and technologies is regularly created in large scale foresight and road mapping projects. However, these foresight and road mapping activities are very expensive and often resource intensive. In this paper, we present a method to collect this information from internet sources and to build semi automatic a knowledge base for strategic long term planning with measures for trustfulness and reliability out of these internet data.

The supply chain system usually is a very complex system. However for simplicity we asume, that there are three layers. First the actual infrastructure layer with different logistic infrastructures, like transport infrastructure, storage infrastructure and e.g. cooling infrastructure. Second the operating organizations of the infrastructure layer form a network structure of stakeholder and actors. Third, some of these stakeholders are involved in discussion about the future of this sector, about threats, road maps and possible structural changes in the future. The following figure shows the interaction of these layers.

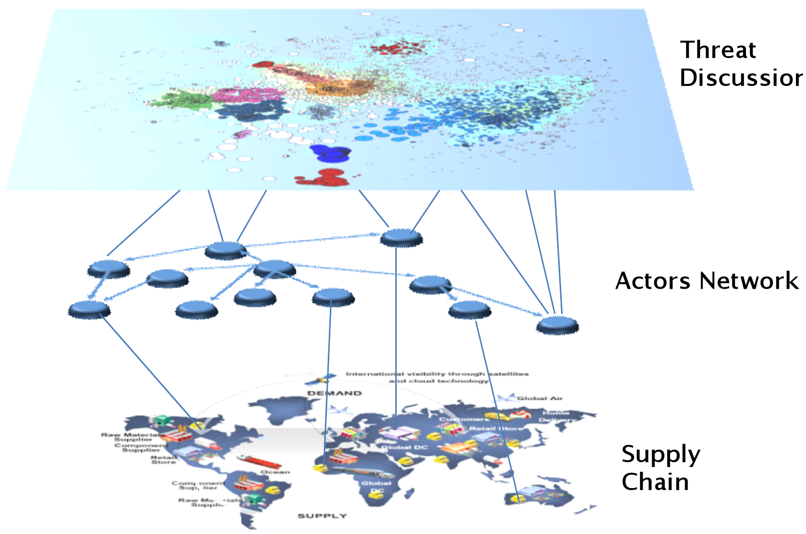

Figure 1: Different layer of supply chain networks (Source AIT, 2014)

Our measures for trust and reliability are based on the core concept of long term learning in future research. They are typically developed in large scale planning and foresight processes. However there is a remarkable probability that after a few years there are disruptive events, which causes structural changes and undermines trust and reliability of these planning processes. Therefore we developed a software for automatic scanning internet sources for weak signals of potential future disruptive events.

Finding potential new threats and disruptive events on the internet is notoriously difficult for an automated scanning process. Humans usually use semantic judgments to decide whether there is a threat in an internet discussion or not. Whether this threat is new, emerging or of declining importance is even more difficult for humans to find out. It is specific to our method, that we will not try to copy the human approach but use statistics to identify potential weak signals. In an initial crawling stage our agent loads search results from a search engine like Google, which are considered as relevant for the search, i.e. in our case for threat identification. The agent then follows each of the links extracted by the search engine to a result list and downloads the corresponding text information. If this text contains the search string, our threat identification agent (TIA), developed in ETTIS extracts title, keywords and main text, and notes the results in the site repository. It then extracts all links from this "relevant" site and adds them to the link repository.

In a second and final stage of data acquisition, the agent iteratively follows all extracted links, again extracts the site attributes and once more tests whether the main text of the site contains the search string. To prevent the agent from being drawn into "black holes"[1] for internet crawlers the agent will not download more than about 1000 documents from a single domain. All text results are grouped by domain, so that there is a consistent domain – text/date relation in the database. This database forms our data source for a topic map analysis.

Based on the downloaded dataset, the threat identification agent (TIA) uses hyperlinks from already identified community sites to find new community sites. By using hyperlinks, the agent makes use of wisdom of the crowds in a way that it uses links as expressions of trust from the source site to the link target site. As our potential text corpus on the internet contains hyperlinks, the text corpus can be thought of as a directed network, with authorities and hubs, in which an authority node is a site with a lot of inbound links, and a hub is a site with a lot of outbound links. Each node in the network has some text online, which can be used to form topic clusters.

2 Results

As a result, we receive topic cluster out of threat discussions on the internet. The clusters give an overview of the topics discussed in the community. As the whole text corpus is about future threats, the identified topics sum up the discussions about future threats.

For a detailed analysis the identified discussions are manually analyzed to identify the potential for a weak signal. Weak signals are small and therefore often early signs to events, which point to future threats, opportunities, needs or wild cards. In particular, the weak signals with a potential to be a wild card often points to future strategic discontinuity. Therefore they have a high analytical value for strategic long term planning.

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[1] http://stackoverflow.com/questions/4512936/what-techniques-can-be-used-to-detect-so-called-black-holes-a-spider-trap-wh

Threats can be a warning that one is going to hurt or punish someone, they can be a sign of something dangerous or unpleasant which may be, or is, about to happen, or they can be a source of danger.[2] In each meaning, the following 3 essential elements are part of a threat:

- a harmful event
- a cause of this event (either accidently or by intention)
- a effect of this event

Based on the wide geographic distribution of threat discussion on the internet, identified by TIA, it became obvious in the analytical work, that a threat is a subjective interpretation of a specific event. If this event is harmful to a person or a group, this event is considered as a threat from all group members. This opinion is not necessary shared by other groups and all other humans. In particular, there might be another group, who takes advantage from this event. The group will not usually consider this event as a threat. Therefore, threats are always subjective expression of values shared within the group. The same applies to opportunity. An **opportunity** might either be a favourable or advantageous circumstance, occasion or time, or a chance for progress or advancement. The advantage is usually related to a specific group. Thus this group will consider the favourable event as opportunity.
Wild Cards are high-impact events that seem too incredible to believe.. Therefore they tend to be overlooked in long term strategic planning. Often it leads even to a decrease in reputation in the peer group, if a member of this peer group starts to discuss a wild card seriously. In futurology, "wild cards" refer to low-probability, high-impact events, as introduced by John Petersen author of 'Out of The Blue - How to Anticipate Big Future Surprises'.[3] However more important than probability is, that these topics are not well known and not part of the mainstream discussion. Often these disruptive events are still too incomplete to permit an accurate estimation of their impact and to determine possible reactions. However for strategic long term planning and scenario development they are very important, as they increase the ability in scenario planning, to adapt to surprises arising in turbulent chaotic environments. In trend analysis, they point to trend breaks and tipping points.
Trend as a future oriented concept is misleading. It is a well-known fact that it is easy to discover a trend based on historical data on the stock exchange. However it is nearly impossible to learn something about the share price of tomorrow from this. A trend in general is a direction, derived from past data. It is usually based on linear pattern, which only work in a specific context. Trends are usually described by time horizon, impact and geographical coverage. Here in this report, a trend is in a way the opposite of a wild card. Trends are expected events and wild cards are surprising events.

The result of the weak signal scan was a list of about 70 weak signals for either harmful events, threats, trends, wild cards or social needs. Topics out of this list where later on used in the human threat identification.

The following table presents a selection of weak signals, which are relevant for supply chain security.

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[2] http://www.thefreedictionary.com

[3] Petersen, J. (2000) 'Out of The Blue - How to Anticipate Big Future Surprises' Madison Books

Table 1: List of weak signals

Title of weak signal	Domain	Source	Threat	Social Need	Potential for wild card
Stuxnet as first SCADA attack software platform	Nuclear, Environment, Cyber	TIA	x	x	7
Advanced persistent threats (APT), like Ghostnet	Nuclear, Environment, Cyber	TIA	x	x	6
Black Market prices explosion of Zero day exploits	Cyber	TIA	x	x	8
Military cyber attack unites	Nuclear, Environment, Cyber	TIA	x	x	9
Modular botnet development platforms	Cyber	TIA	x	x	6
Trojan horse software service industry	Cyber	TIA	x	x	6
Globalisation, strategic sourcing and cloude services	Cyber	TIA	x	x	8
Global advertising networks and private data exchange	Cyber	TIA	x	x	10
Dark nets and cryptographic peer to peer nets for anonymous publishing and whistleblowing	Cyber	TIA	x	x	9
Global black hacker industry and black markets	Cyber	TIA	x	x	7
Epistemic networks for knowledge exchange in organised crime	Cyber	TIA	x	0	7

Source: D 4.4 ETTIS, AIT

3 Consequence

As a consequence from our experience with internet scanning, the scanning is very much driven by the definition of the search issue, which is reflected in the search strategy. Scanning activities will become better when expert experience in a specific domain is used to define the search strategy and a domain specific knowledge management is used to cluster the results. In general this implies, that repeated scanning can and should be used for iterative improvements in scanning activities.

In principle the internet is a suitable source for such a broad scanning. However, the finding from internet sources needs additional human reasoning and interpretation in order to extract more consistent and accurate insights. In the process of sense making all categories of future issues (threats, needs, wild cards, disruptive events and so on) became more accurate. The precise knowledge about these different types of issues was not available at the beginning of the project. Taking into account, that this knowledge is helpful in scanning the internet, a repeated scan would lead to more precise results. This is a strong argument for setting up a horizon scanning center with a proper knowledge management.

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Importance of risk management for the security of smart grids[1]

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Abstract: Future energy grids will make extensive use of the integration of ICT technologies. Thus, cyber security risks become a threat even for energy suppliers. Numerous security issues are completely unsolved today, because these special environments require novel security mechanisms and processes. The aim of the project (SG)² is therefore a systematic study of smart grid technologies in terms of ICT security issues and the research of countermeasures. Based on a thorough threat and risk analysis from a national perspective and specific security analysis of Smart Grid components, (SG)² explores measures for power grid operators that serve to increase the security of computer systems deployed in the future critical infrastructure of "energy".

Keywords: Smart Grids, Security, Risk Management, Energy, Vulnerability, Critical Infrastructure

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[1] The contents of this paper were published partially for the 13th Symposium for Energy Innovation 2014, Technical University Graz (Göllner, Meurers, Peer, Langer, Kammerstetter 2014).

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1 Existing approaches

State-of-the-Art Risk Models like the "ISO 27000 Standards" and "IT-Grundschutzkataloge" of the German Federal Office for Information Security (BSI) and the integration of results and different approaches out of several research projects build the foundation of the work on risk models for the security of smart grids. Therefore it is necessary to categorize events and incidents following a categorisation system like the "double vector model" (Göllner, Meurers, Peer, Langer, Kammerstetter 2014), which was developed, evaluated and enhanced in the context of the research project „Szenarioplanung und Wissensmanagement im ÖBH" of the Federal Ministry of Defence and Sports. With this model it is possible to document and provide relevant content concering events and incidents for further analysis and allows the differentiation of events by factors referring the

- organization
- causers/initiators
- type of the event
- timely framework
- dimension/influence and the
- abstractional level.

Every incident or event can be categorized, documented and be related to actors and knowledge role models to recognize correlations and dependencies in order to provide information to analysts or to identify additional demands for information.

2 The $(SG)^2$ Risk Catalogue

The purpose of the research project $(SG)^2$ was to develop a risk catalogue for Smart Grid Operators in Austria to support enterprises in the energy supply sector in a comprehensive risk analysis of their systems. Based on the developed high-level reference architecture (*Smart Grid Architecture Model*) of CEN-CENELEC-ETSI (CEN-CENELEC-ETSI, 2012) a ICT-architecture model for Austrian Smart Grids was defined and integrated into a risk catalogue. After linking components and connections of the reference architecture to specified domains (i.e network, metering, enery production facilities) threats and vulnerabilites were identified following the basic approaches (IT-Grundschutzkataloge, BSI-Schutzprofile) (BSI 2013a, BSI 2013b, BSI 2013c).

These threats were summarized, categorized and mapped to the specific context of Smart Grids producing a list of 31 threats, which were evaluated and reviewed within the scope of the underlying ICT-architecture model. In the next step the risk potential for each threat was determined representing the probability of occurrence and the possible damage. Energy Suppliers can use this list, the $(SG)^2$ Risk Catalogue and the visualization of the risk potential of possible threats for a concrete risk analysis within their implemented systems.

3 Evaluation

The ongoing transformation of energy networks to Smart Grids and the following integration of ICT multiply the need for an evaluation and assessment of emerging risks to identify and enable an improved protection of critical infrastructure sectors. However, a risk assessment requires a detailed view on the system landscape of energy suppliers. The often existing lack of risk assessment including the complete architecture confronts energy suppliers and network carriers with the need for proper risk management methods in the field of Smart Grids.

Contrary to analyzed existing methods within the EURACOM FP7 Project (FP7, 2013), the $(SG)^2$-Risk Catalogue follows a comprehensive approach considering the overall architecture and allows the combination of an architectural risk assessment with a detailed, individual risk evaluation in order to identify risk potential and probabilities of occurrence.

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Meta risk model for critical infrastructures

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Abstract: In this article we provide an overview on state-of-art risk assessment methodologies and introduce a generic comprehensive approach for the development of a meta risk model, which is further used to build a sensor-driven risk analysis and risk management system. In the course of this, knowledge management as well as risk analysis and risk management disciplines (e.g. the Double Vector Model, meta heuristics, etc.) and their respective application in the strategic and operative context of ICT and critical infrastructures are evaluated and integrated into a meta risk model to guarantee the feature-based organizational development, governance and controlling on an operative level.

Keywords: Risk Management, Risk Assessment, Risk Analysis, Decision Support, Heuristics, Critical Infrastructures

Acknowledgement: This research is supported by the Austrian Research Promotion Agency (FFG), grant number 840905, within the KIRAS security research program by the Federal Ministry for Transport, Innovation and Technology. The contents of this paper represent the results of the current project work and the submitted proposal (KIRAS 2012).

1 Intention and domain

A comprehensive risk management is the foundation of all management, core and support processes in an organization. Based on a knowledge management system, it represents the background of all measures regarding the feature-based organizational development, governance and controlling. In particular, in the security-relevant area a special emphasis is laid on risk management on a strategic and operative level due to the sensitive tasks and challenges in this area.

There are numerous guidelines and methodologies towards risk assessment and risk management throughout various fields of application (cf. ISO 31000, ISO 31010, ISO 27005, ISO 28000). This includes sectors like the IT security, the telecommunication sector or the financial sector. Nevertheless, the risk management systems used in these sectors are highly domain specific and only valid as long as the assumptions, on which these systems are built, do not change. This includes even well-established approaches like the Business Continuity Framework of the Bank of Japan (Bank of Japan, 2014). Often, these approaches focus on financial risks or IT risks but do not take other influence factors into account. Such an approach might have a huge impact if the respective assumptions it is based on change, as seen in the case of the tsunami in Fukushima, where a total blackout of the power supply was not considered at all.

The intention of the work and the focal point of the underlying R&E project “MetaRisk” is the development of a comprehensive meta risk model based on a generic approach to describe organizational structures and the interconnection between them as well as to increase the quality of scenario development covering potential threats. To achieve that several risk management approaches from different sectors (IT security, financial, logistics, etc.) are evaluated and combined to define the meta risk model.

2 State of the art

It is a common practice to use a well-established risk model from one domain and apply it to other domains than the original one, without considering the adaption of the model due to the different situation in the new domain. This “copy and paste” application of risk models often results in the use of terms from financial risk or IT risk in a new context, which they are not designed for.

In principle, choosing the right method or the right tool to perform risk analysis, risk assessment and risk management turns out to be rather complicated. In this context, a set of concepts, algorithms and tools has been developed over the last few years, which are specifically designed to protect the IT infrastructure and related systems. Based on their historical background in economics, these methods often provide a quantitative approach to risk assessment in terms of monetary values (cf. (Peltier 2001), (Schechter 2004) and the EBIOS method as well as the ISO 27005 standard). Hence, most of the tools and methodologies (cf. (ENISA 2010) for an extensive list of examples) only support the common rule "*risk = potential damage x probability of the respective event*". Further, depending on the applied methodology, the terms and scales for the assessment of the potential damage and the probability of the respective event are fixed (cf. for example the NIST directives (Stoneburner, Coguen and Feringa 2002) or the MEHARI method (CMC 2004)). Therefore, the selection of a specific tool or method for risk assessment and risk management is often based on practical considerations and depends on how far the present terminology of the application can be mapped on the specific terminology of the respective risk assessment methodology.

In order to structure the process, there already exist various attempts to develop ontologies for generic risk assessments (Kollartis, Wergles, Siegel et al. 2008). For example, the AURUM system (Ekelhart, Fenz S. and Neubauer 2009) provides a graphical tool to build models based on ontologies, using a Bayesian approach for determining threat probabilities. The OCTAVE method (Alberts and Dorofee 2002) is based on subjectively estimated probabilities and can thus be understood as an a priori distribution in the Bayesian approach. It represents a comprehensive collection of tools and best practice methods for risk management in the field of IT-security.

Although there is a lack of a comprehensive risk assessment and risk management model, most of the models and approaches mentioned above can be reduced to an abstract level and serve as basics for the development of the meta risk model. The challenge of designing and modeling is not only the specification of the generic level but also the granularity of the derivation of the analyzed risk models and approaches in order to guarantee the integration of all relevant factors, processes and methodologies into the meta risk model as well as the suitability for different fields of application..

3 Further work

The topics presented in this article concentrate on the development of a sensor-based risk analysis and risk management system using a comprehensive approach for a generic meta risk model. The aim of the conducting project is not only to model and design the system based on this meta risk model but is also to implement a respective software demonstrator for decision support. In the course of this, results from previous research (Schiebeck 2007, Schiebeck 2013) as well as methodologies, techniques and technologies are integrated into the meta risk model. Furthermore, existing scenario modeling techniques (Pillkahn 2007), classification systems (Göllner, Meurers, Peer et. al. 2014), systems engineering (Göllner, Meurers, Peer et. al. 2010) as well as developed processes, control logics and risk models are combined in the system. To define the correlations between the key performance indicators (KPI) and key risk indicators (KRI), basic sensors, interfaces of analytical instruments (e.g. SNA, Social Network Analysis (Göllner, Meurers, Peer 2011), KIRAS-MDL, etc.) as well as expert knowledge are discussed, formalized and mapped to the system and furthermore integrated into a software demonstrator.

The generic approach and the underlying meta risk model guarantees the possible usage of the system for different domains like supply chain networks, energy sector, finance market etc. and the integration of all relevant knowledge, methods, processes and sensors.

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Modelling simulation-based decision support in the last mile of crisis management

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Abstract: The research described in this paper focuses on the development of a cloud-based simulation and operations research toolkit which is integrated in the control information systems for tactical and operative planning support. It provides decision-makers with status reports as well as simulated scenarios and analyses of future developments. In combination with quantitative methods, this should contribute to improving the response to disasters and to providing better support to victims. Moreover, the usage of the toolkit in training helps to identify crucial skills required and can lead to a

better understanding of relief processes, especially due to the focus on private and public coordination within this project.

Keywords: disaster management, crisis management, model-based simulation, decision support, cloud-based, operations research, interface problem

Acknowledgement: This research is supported by the Austrian national KIRAS programme since 2013, and is funded by the Federal Ministry for Transport, Innovation and Technology

1 Motivation

Disasters cause complex scenarios which require coordinated actions of various organisations[1] to reduce resulting damages and to support victims efficiently. Due to the involvement of multiple actors in the relief process, where actors differ in their missions and goals, coordination is essential; however, an efficient and effective coordination is difficult and time-consuming to achieve.[2] As the velocity of decision-making is crucial in such scenarios, a close cooperation between private and public organisations is necessary. In combination with the usage of decision-support tools to simulate and analyse the current situation and expected developments, these factors have a strong impact on the overall effectiveness of the response to disasters.
Due to damaged infrastructures and limited resources, last-mile distribution is especially challenging. Basic goods of daily life, such as food, have to be transported to the location of the disasters by private and public organisations in order to assure the stable operation of communities affected by disasters. The general situation in case of an disaster is shown in Figure 1.

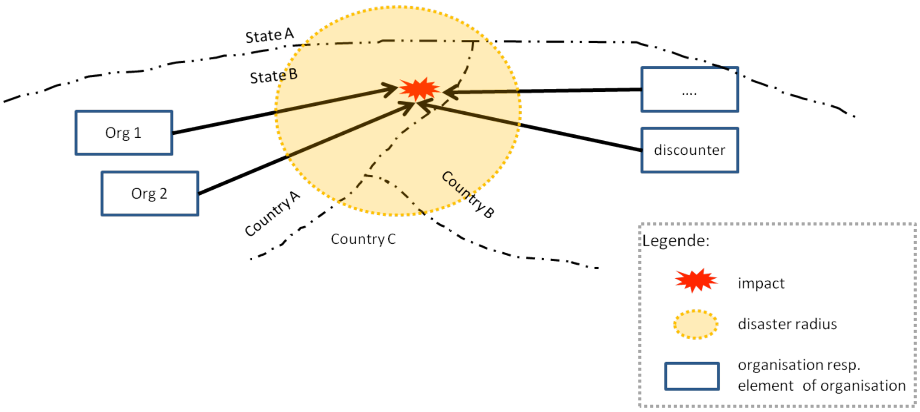

Figure 1: disaster situation[3]

[1] Ministry of Interior: Coordination of crisis and disaster management, 2011, vienna

[2] Christensen: Assess your capabilities. Leadership Excellence, 2006

[3] Born, Fikar, Gatarik, Göllner, Gronalt, Hirsch, Peer, Quirchmayr: Modelling simulation-based decision support in the last mile of crisis management, proposal LMK-MUSE, p. 17, 2013

A disaster occurs with or without advanced warning time. So the pre-execution phase may be long or very short. Figure 2 depicts a generic 5-phases model developed at the National Defence Academy of the Austrian MoD.

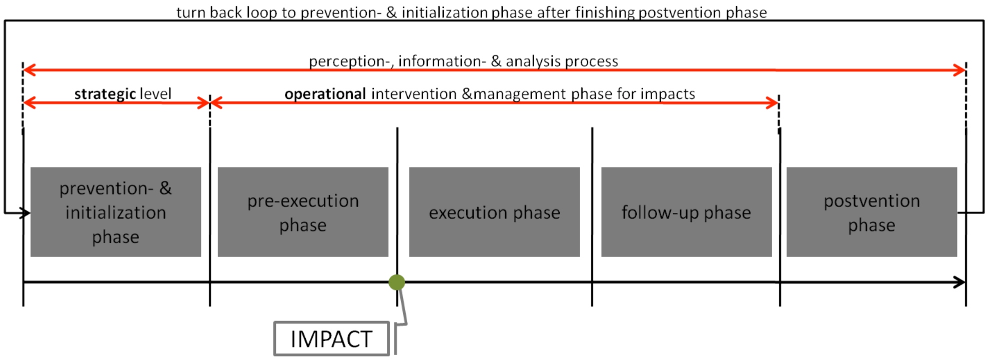

Figure 2: 5-phases disaster model[4]

According to the above model, first responders or other actors face different challenges and requirements in crisis and disaster management depending on the management / leadership level (strategic, operational etc.) as well as the phases themselves.

2 Scope of the project

„No single country is able to tackle today´s complex problems on its own.“[5]

Within the scope of the research project "Modelling simulation-based decision support in the last mile of crisis management", a common terminology has to be defined to enable better coordinated processes. By development of a cloud-based simulation and operations research toolkit which is integrated in the control information systems for tactical planning support, optimized transshipment points and real-time schedules of relief shipments can be identified. This leads to a faster and more efficient disaster relief. The general interface problem is shown in Figure 3. This generic topic, referred to the "Doppelvektormodell"[6], applies to:

- personnel
- equipment
- facilities
- information and telecommunication systems
- action forces
- mobile vehicles and
- the legal compliance aspect.

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[4] Backfried, Göllner, Quirchmayr, Rainer, Kienast, Thallinger, Schmidt, Pfeiffer, Meurers, Peer: Cross-Media Analysis for Communication during Natural Disasters, p.7, accepted paper, 2013

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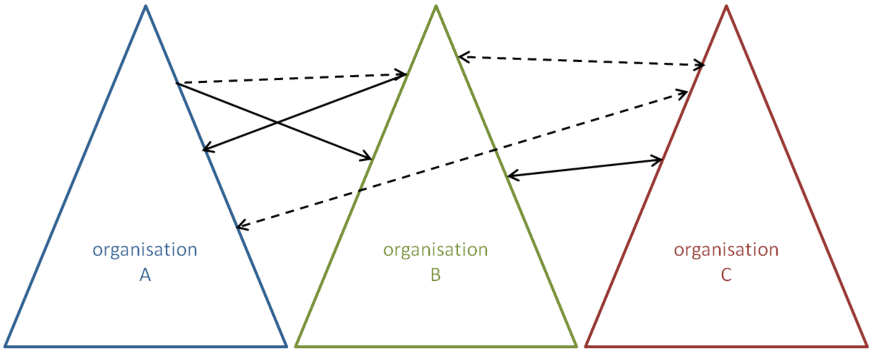

Figure 3: interface problem[7]

Furthermore, decision makers can be supported by a meaningful processing of available data and a detailed overview of the current situation. This is not only provided in a classic two-dimensional way, but three-dimensional, based on topographic features and additional external factors. Additionally, different scenarios can be simulated by an integrated agent-based simulation. By having better knowledge about potential developments, counter-measurements can be initiated and relief process adapted. By providing real-time information of available resources and their current (readiness) status in a common database to various actors, closer cooperation and more efficient mechanisms are facilitated.

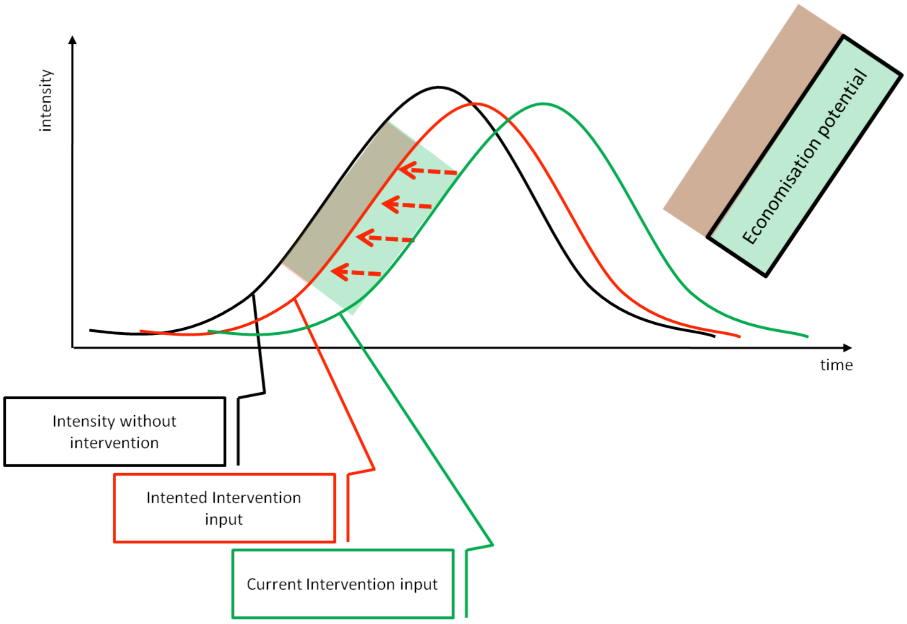

Figure 4: intented economisation potential[8]

As a result, decision-makers are provided with a powerful and integrated toolkit to react to disasters in a fast and efficient manner. Coordination between various actors is supported and various scenarios are considered. Moreover, the usage of the toolkit in training helps to identify crucial skills and can lead to a better understanding of disaster scenarios, their developments and efficient measurements to improve the quality of disaster relief in Austria and in transnational disaster relief efforts.

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Research at the institute is mainly centered on the topics:

- BioEnergy, Forest based industries and Transportation Logistics,
- Advanced planning in process industries,
- Mobile Health Services and
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For the research on simulation and capacity analysis of Binnenland Container terminal the Institute was honored with the Austrian State Award for green logistics in 2007.

Prof. Gronalt was member of the department steering comitte from 2004 – 2009 and also member of the university council. He is also member of the executive board of the Austrian Institute for Sustainability and with the german association of logistics (BVL) he is academic member of the jury for awarding the sustainability price 2013 and 2014.

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Risk analysis for “Schutz 14”

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Abstract: The internal research described in this paper focuses on the identification of a risk index for the critical infrastructure railroad in Tyrol. The result is used for the further planning and decision making process for the military training exercise “Schutz 14” in June 2014. The risk analysis was done in autumn 2013 from an expert team consist of members of the Military Command of the Tyrol and the National Defense Academy. The result of the research should be the basis for further researches[1] to handle the complexity of various critical infrastructures as a support for the ongoing decision making process.

Keywords: supply chain, railroad, risk analysis, decision support, critical infrastructure, risk index, system thinking, scenario development

Acknowledgement: This internal research was supported and funded by the Austrian Armed Forces.

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[1] Submitted proposal for the Austrian national KIRAS program in 2014

1 Motivation

In June 2014 takes a national military training place in Tyrol with the focus on protection of critical infrastructures with military and civil organizations and institutions. Beside the ongoing decision making, General Bauer, the Commanding Officer (CO) of the Military Command of the Tyrol and responsible for all territorial aspects, decided to start a parallel risk assessment of the railroad as one of the critical infrastructures in Tyrol. The risk analysis was done in autumn 2013 from members of the Military Command of the Tyrol and the Section for Knowledge Development in the Department of Central Documentation and Information from the National Defense Academy of the Federal Ministry of Defence and Sports.

The motivation was to identify a risk index for the railroad based on the generic "Doppelvektormodell"[2] which was developed at the Department of Central Documentation and Information in 2011 and the previous researches in the topic of critical infrastructure[3].

2 Process

The research followed the identified process which is shown in Figure 1.

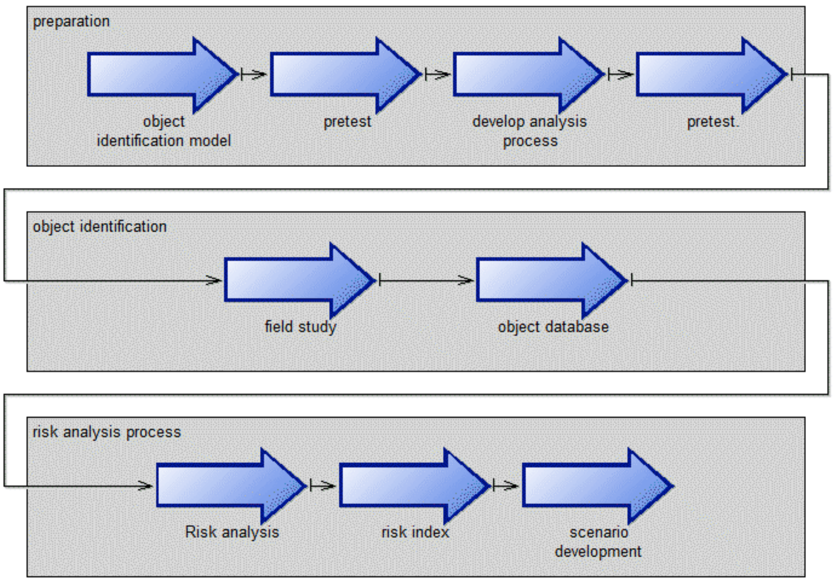

Figure 1: meta process[4]

During the preparation phase a model to categorize objects and other relevant parameters was generated and pretested on site. Also the further steps for the analyzing process were generated and tested in this phase.

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[2] Göllner, Meurers, Peer, Langer, Kammerstetter; Bedeutung des Risikomanagements für die Sicherheit von Smart Grids, accepted paper, 13. Symposium Energieinnovation am 12.-14. 2014, Graz

[3] Göllner, Kienesberger, Peer, Schönbacher, Weiler, Wurzer: Analyse und Betrachtung von Kritischen Infrastrukturen; Wissensmanagement im ÖBH-Systemdefinition, -beschreibung und –begrenzung zur Szenarioentwicklung und –modellierung, Supplement im Rahmen der Reihe „Grundlagen zum Wissensmanagement im ÖBH", Schriftenreihe der Landesverteidigungsakademie, 2010, Wien

[4] Created by Peer, Göllner, Haberfellner, 2013

In the object identification phase a team of at least two persons filled all objects and relevant parameter in prepared sheets. In another step the information of the field study were transmitted in specific database.

Referred to the “Doppelvektormodell” various models to attribute the identified parameters were generated in the risk analysis process phase. Of course the results of the singular models must be connected together to represent the complex situation of the evaluated system.[5] An abstract of one Model is shown in Figure 2.

Hier sind die unterschiedlichen identifizierten Infrastrukturen/Objekte hinsichtlich der spezifischen Parameter (x-Achse) zu bewerten.	Kritisch !!	ÖBB								
		Betriebsunterbrechung				Ressourceneinsatz				
		keine	kurz	mittel	lang	keiner	gering	mittel	hoch	keine
Gewichtungsfaktor		25				25				
Multiplikator		1	3	6	10	1	3	6	10	1
Mauer		1				1				
Unterführung		10				3				
Nebengleise		1				3				

Figure 2: rating specific parameter (abstract)[6]

The necessary Models are generated like the identified objects attribute to identified parameters on the y-axis. An extract of these parameters on the y-axis were:

- Austrian Armed Forces (AAF)
  - resource management equipment
  - resource management personnel
- Austrian Federal Railway (ÖBB)
  - business interruption
  - resource management personnel/equipment
  - costs
- event orientation
  - technical threats
  - environmental threats
  - civil threats
  - legal compliance
  - political threats
  - socio-economic threats

These models were categorized in various layers and the last one is exactly characterized to allow the relation of an at least 4-step scale.

The use of the “Doppelvektorenmodell” ensured that the analyzing steps were done under a widespread view to gaze at the independent influence. So for instance the effect of the general and the specific energy supply took influence as the impact of the identified threats on the different identified objects. For this the model connect the identified topics for

- event orientation,
- time orientation,
- organizational orientation,

[5] Göllner, Meurers, Peer, Povoden: Einführung in die Soziale Netzwerkanalyse und exemplarische Anwendung, Wissensmanagement im ÖBH-Systemdefinition, -beschreibung, und –begrenzung zur Szeanrioentwicklung und –modellierung, Supplement im Rahmen der Reihe „Grundlagen zum Wissensmanagement im ÖBH“, Schriftenreihe der Landesverteidigungsakademie, 2011, Wien

[6] Created by Peer, Göllner, 2013

- space orientation,
- trigger orientation and the
- level of abstraction orientation.

3 Aim/result of the research

In this research the critical objects were identificated specific for the distance scale and the two demand carriers, the Federal Ministry of Defence and Sports and the Austrian Federal Railway. The most important result of the research was to create a risk index for, in this specific case, two demand carrier to support the decision making process for the preparation of the exercise “Schutz 14”. Another result was to create demand carrier specific scenarios based on the risk analyzing process. So the comparison with existing results of further analysis was done as the comparison with the military analyzing process. Of course there was a lot of added relevant information like the risk index with combine the complex situation of one supply chain as critical infrastructure in the area of Tyrol.
As an example the identified critical objects in the evaluated system are visualized in maps for the planning process and the use for the various military and civil elements on site.
The generic risk analyzing process model can easily be used for other supply chains, supply chain networks or other demand carriers to indentify critical infrastructure elements or objects and of course the interdependent influence.

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Security strategies towards mutually dependent goals

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Abstract: Quantitative risk management is a rarely used approach in enterprise security, as it relies on hard to obtain information, whose lack of accuracy or reliability is often inhibiting reasonable conclusions. In restricted cases, however, it is indeed possible to apply game-theoretic techniques to tackle very basic problems of data processing. In this article, we describe a game-theoretic approach to quantitative risk management concerning the security of data transmissions within an enterprise network. Essentially, we outline project efforts towards setting up communication channels similar to a virtual private network, using game-theory and avoiding conventional encryption and hence key-management. Since the latter is most prone to human error, game-theoretic techniques appear interesting and are subject of this article, since they reduce the extent of human responsibility while at the same time providing us with mathematically sound risk estimates.

Keywords: Risk Management; Game-Theory; Security

Acknowledgement: This research was supported by the Austrian Research Promotion Agency (FFG), under KIRAS research grant 836287.

1 Introduction

Risk management is a core duty of (enterprise) leadership. While qualitative approaches are mostly supported by best-practices and a vast amount of literature, qualitative risk assessment makes cost-benefit analysis somewhat difficult and subjective to a considerable extent. Related literature, such as the ISO standards, the Common Criteria or the guidelines published by the German Bundesamt für Sicherheit in der Informationstechnik (BSI), is an indispensable tool for risk (threat) analysis, yet little is said about how to handle risk in situations where the range of attacks, yet not the adversary's actions, can meaningfully be modeled. It follows that much effort is usually spent on gaining ideas of what the attacker actually intends in order to estimate the most likely spot for a concrete attack. However, taking an alternative view focusing on the best protection against possible damage can spare most of the modeling related to the attacker's behavior. For that sake, we simply assume the attacker's motivation to be causing the maximum possible damage in a system. While this certainly misjudges the attacker's real intentions, it nevertheless is a reasonable worst-case assumption that lets us derive countermeasures against which any possible scenario (within the range of known attack strategies) can cause only less harm than we predicted.

2 Secure transmission as a mathematical game

More technically, security can be treated as a mathematical game, in which the prize is the value of secret information (or more generally, the damage that an attack would cause), and the winner is either the honest or evil player (but not both). To model the attacker's worst-case behavior, we define the situation as a zero-sum game, in which the revenue for the honest party and the attacker is the business value that is processed (exchanged over a perhaps partially hostile communication infrastructure, stored at a possibly untrusted location, etc.). This game-theoretic approach is not new, and has been proposed in various preliminary works on secure communication and general quantitative risk management (Alpcan & Başar 2010, Cavusoglu et al. 2008, Lye & Wing 2005). Along the course of the SERIMA project ("IT-Security Risk Management using Decision Theory", funded by the Austrian Research Promotion Agency FFG), the game-theoretic modeling and analysis has been applied to the rudimentary problem of private communication between two peers in a partially distrusted network. The only assumption made in the game was the attacker having full control over a limited set of nodes in the network, while the system determined the optimal routing strategy to bypass the attacker with maximum probability □(□,□), when □ is a transmission configuration and □ is an attack strategy. Game-theory allows us to randomly choose both parameters, so as to optimize the revenue for the honest parties, while simultaneously finding the optimal attack profiles. In theory, it could be shown that this enables arbitrarily secure (confidential) communication, provided that there is an (arbitrarily small) chance to circumvent the attacker, while allowing the enemy to be even mobile (it may conquer different parts of the network infrastructure at different times, yet the total range of the hostile area remains bounded at all times). Most importantly, this form of confidential transmission is not based on encryption, thus requires no management of public-keys or secrets for symmetric encryption.

Going one step further, the RSB project ("Risikomanagement für simultane Bedrohungen"; funded by the FFG as a successor project of SERIMA) extends the investigation towards taking more security goals into account. In detail, RSB defines security as comprising confidentiality, authenticity and availability, where the game takes multiple goals for the honest parties into account. While much of the theory used in SERIMA no longer holds in the multivariate case of RSB, the theory could nevertheless be reformulated in this generalized setting, with optimal defenses remaining computable even with respect to multiple inter-dependent security goals. As a neat feature, the modeling does take into account an implicit or hidden interplay between security goals, while it does not require any explicit modeling of such interdependencies. Consequently, even though risks may nontrivially depend on one another, the game-theoretic modeling spares us the need to understand or model such interplay.

More precisely, the RSB approach defines a separate individual indicator variable for each security goal, say confidentiality (captured by the probability function □1), authenticity (captured by the probability function □2), etc., and computes a defense strategy that enjoys two properties (Rass 2012):

1. For each security goal, the optimized indicator average □ lower bounds the likelihood to be successful in the security goal that it refers to.
2. The obtained bounds cannot be uniformly improved by switching to another transmission configuration in the sense that any deviation from the optimal defense will eventually yield a worse than optimal performance in at least one aspect of security.

These two axioms capture the properties that the one-dimensional indicator (used in SERIMA) naturally enjoyed, and are therefore a sound generalization of game-theory to the treatment of multiple and interdependent security goals. As discussed in detail in the SERIMA project, it is easy to analyze a zero-sum competition between two players fighting for a single goal. In that case, it is easy to bound the payoff for the honest player who attempts to maximize his own good, while the enemy tries to minimize the outcome. However, in the multivariate case, we are forced to consider Pareto-optimal behavior instead, where we can only optimize a tradeoff between what is achievable, if we cannot optimize all aspects of interest individually. This makes the obtained defenses necessarily ambiguous, as well as the optimal attack strategies. The latter have a particularly interesting interpretation, as these show possible scenarios of worst-case incidents, alas, the identification of such is in no way exhausting. Nevertheless, fixing the defense against one scenario and running the analysis again will eventually dig up further threats against which further countermeasures can be installed. In this iterative fashion, game-theory helps to create a comprehensive defense by repeatedly playing the game (which is simulating optimal attacks) and deriving countermeasures from it.

Basically, any network provisioning is compatible with the game-theoretic modeling, provided that there are degrees of freedom that a sender of secret information can use to introduce randomness for an attacker. In our case, this network provisioning is based on source routing that can be done on OSI layers 2, 3 or even 7 (to gain maximal flexibility and ease of use). For secret transmission, we randomly switch paths to prevent a (static) attacker to eavesdrop on all parts of the message. By choosing a proper encoding, the missing parts of the message act like encryption keys, however, without requiring any explicit key-management. For authenticity, we apply a reputation-based technique (Rass & Schartner (2010)), that is, we let the sender attach a message authentication code, whose verification is up to designated parties in the network, with whom the sender shares some secret knowledge (this application of symmetric cryptographic techniques is the only case where key-management is required).

3 Ongoing works and outlook

Open issues with the technique concern its applicability to other security goals like non-repudiation or anonymity. This is subject of follow-up research. Ongoing work concerns the evaluation of efficiency and scalability of the methods. While for SERIMA, we have been able to analyze and provision hierarchically structured networks (wide-area networks that connect smaller local area networks) of a total of 10.000 nodes (SERIMA Consortium 2012), similar benchmarks for the RSB method are not yet ready. To this end, we defined a virtual enterprise infrastructure, in which we will set up a demonstrator and run experiments. The testbed is a generic model of an international holding. This corporation with a pharmaceutical background employs more than 18.000 personnel and besides the headquarters there are 18 independent branches dislocated in all continents. Three product lines (tablets, liquids and crown caps) and distribution branches are part of the holding. Every organizational element is structured to identify the relevant internal (e.g. communication lines between offices) and external (e.g. relevant lines to distributers) gateways for the further testing. This hypothetical pharmaceutical corporation can easily be replaced by a consisting organization to switch from the laboratory situation into real situation. More importantly, the simulation testbed provides realistic communication scenarios and traffic loads, to evaluate the usability of the RSB techniques in a large-scale setting.

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Modelling collaborative cyber-physical value networks as next generation supply chains

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Keywords: Cyber-physical systems, supply chain management, supply chain/network modelling, collaborative networks, structure dynamics

Acknowledgement: This work has been greatly stimulated by interesting conversions with colleagues from different domains including supply network design, system theory, computer science, and bioscience as well as interesting readings by Anderson (2012) and Typscott/Williams (2008).

The majority of todays' companies are still organized based on the principles of the Scientific Management defined back in the days by Frederick W. Taylor. Similarly, contemporary supply chains (SC) are predominately managed through the integrated approach of value chains once defined by Porter in 1985 (Reichwald, Piller, 2009). Both archaic theoretical frameworks put a strong emphasize on high operational efficiency, central planning and controlling competence, hierarchical, static and isolated structures as well as customer decoupling from value creation. Correspondingly, many recent models on SC design, planning and operations are grounded on those peculiarities (Chopra, Meindl, 2010). However, current advancements in information technology and customer integration as well as consistently high volatility on markets challenge the validity of existing decision support models in supply chain management (SCM) and necessitate a critical review of underlying modelling frameworks.

Since SCM stresses the role of coordinating systems (Simchi-Levi, 2008) aspects of system thinking need to be incorporated in both managing and modelling supply chains. More specifically, holism, interdependency as well as dynamics represent key attributes that need to be considered in supply chain modelling. This central claim is further motivated by looking at two recent trends which will fundamentally affect the way of doing business in the future: collaborative networks (CN) as well as cyber-physical systems (CPS). The former constitute a proper concept to the traditional term *supply chain* these days. CN consist of a variety of entities (e.g. people, products, organization, etc.) that are autonomous, heterogeneous, spatially distributed and interconnected by computer networks for the purpose of better achieving common or compatible goals (Camarinha-Matos, Afsarmanesh, 2005). Cyber-physical systems represent an enabling information technology (IT) for decentralized-controlled collaborative networks through integrating physical entities, e.g. products, manufacturing equipment or transport vehicles, in digital networks and coordinating in real time (Acatech, 2011). Both trends also enhance customer integration (CI) which induces customers to move closer to the value creation process. As can be anticipated, this set of influencing factors requires a different modelling framework than those broadly applied today.

The transition of modelling linear supply chains into complex collaborative cyber-physical value networks (CCPVN) call for an in depth investigation of the structure, behavior and, especially, dynamics emerging in these networks. Ivanov, Sokolov and Kaeschel (2010) examine supply chains as dynamic systems and proposed a multi-structural framework for analyzing supply chain structural interrelations and dynamics. Therein, interrelated structures are specified as follows: product, functional, organizational, technical-technological, topological, financial and informational, whereat the latter increasingly affect the other structures due to emergence of cyber-physical systems. This multi-modelling texture may alter over time resulting in variants of *supply chain multi-structural macro-states*. The ability to map such functions of structures and states enables an impact assessment of decisions made within the network on the one hand and externalities biasing interrelated network structures on the other hand. In Ivanov and Sokolov (2012a), structure dynamics control based models (SDC) are introduced as a potential approach for a multiple-model complex and is built upon optimal program control theory, active modelling objects, and mathematical programming. Both, the multi-structural perspective as well as the integrated modelling tools have been identified as a suitable modelling approach for the next generation of supply chains, so-called collaborative cyber-physical networks (Ivanov, Sokolov, 2012b). The vision of the inter-disciplinary modelling framework developed by Ivanov and Sokolov is fundamental to this paper. Yet, implications of the above-mentioned influencing variables, i.e. (i) availability and dominance of real time information as well as (ii) intensified customer integration on structure dynamics in value networks remain unexplored in this paper.

The kernel idea of this research paper is to specify the term collaborative cyber-physical networks through answering the subsequent research question:

> *How can structure dynamics in collaborative cyber-physical value networks be modelled facing strong dominance of collaboratively shared real time information and intensified customer integration?*

The following research design is proposed. To start with, a comprehensive literature review of cyber-physical systems, collaborative networks and customer integration is conducted and effects of these trends on future value networks are extracted. Furthermore, existing modelling frameworks not only for economical systems, e.g. supply chains/networks, but also biological systems, e.g. metabolic networks, are reviewed. For instance, Beber and Hütt (2012) address the parallels of metabolism and manufacturing by drawing metabolic modelling principles into the domain of production logistics. This approach ensures a broad and abstract understanding of structural dynamics. All of those findings are synthesized into a generic modelling framework that aims at mapping structures and its dynamics in collaborative cyber-physical value networks. This modelling framework serves as a basis for building up use cases for different industries.

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An advanced risk assessment method for dependency models in critical infrastructures

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Abstract: A sensor-driven risk analysis and management system has been designed and demonstrated as a software prototype to provide advanced dependency analysis and near-real-time situational reporting capabilities by incorporating expert knowledge. The developed model is based on the IT-Grundschutz Framework, incorporating the modular, cross-referenced safeguard and threat models to initially support Information Security Assessments and highly detailed dependency assessments between IT and infrastructure components. However, the model has been designed generically in order to support a wide range of domains and critical infrastructure components. The system also provides the novel ability to assess self-deployable sensors in order to gather security-relevant data automatically. This data can then be provided as indicators for subjective risk model using expert knowledge.

Keywords: Risk Management, Risk Assessment, Risk Analysis, Dependency Analysis, Critical Infrastructures

Acknowledgement: This research was supported by the program line “Trust in IT Systems” of the Austrian Research Promotion Agency (FFG) [819952].

1 Motivation

Previous research in [1; p. 47ff] and [2; p. 69ff] on information security risk assessment methods and tools conducted in cooperation with the Austrian Federal Ministry of Defense has shown the need for a simple, adaptable modeling framework based on standards and best practices that can be extended easily, as well as an integrated framework for metrics and knowledge management, that allows for the exchange of formalized metrics and expert knowledge. Based on these requirements, the research underlying this paper was aiming to:

- identify a generically usable risk assessment approach for information security risks and a supporting library,
- define metrics management and calculation framework,
- evaluate and implement knowledge management approaches for continuous inference and reassessment,
- define an overall framework and methodology, modeling options and aggregation functions,
- design and implement a prototype and supporting system architecture, and
- evaluate and interpret the conclusiveness of assessment results.

Therefore, the objective of this research was the definition of a framework, model and supporting architecture to provide a balanced, manageable way of gaining insight into risks and trends based on a comprehensive role based estimation and assessment framework that is automatically influenced by an expert knowledge system using a small set of selected security metrics that have a high impact on the overall model.

The proposed model consequently provides a framework for extendable technical and organizational sensors that continuously gather various security relevant attributes, derives security metrics and indicators based on ISO/IEC 27004 [3] and uses adaptable knowledge management approaches to continuously infer risk factors of an assessment model based on ISO/IEC 27005 [4], using IT-Grundschutz [5] as an extendable modeling framework.

Based on the high granularity of risk factors, international acceptance, a comparatively easy to handle but comprehensive modeling framework and governmental support, IT-Grundschutz has been chosen as a predefined and pre-evaluated framework of risk factors to support asset modeling. The proposed model incorporates all IT-Grundschutz cross-references [6], follows all IT-Grundschutz standards [7-10] and includes a technique used to model asset dependencies (see Figure 1) and a detailed risk analysis method [9] to support the extension of the model.

The major scientific outcomes of the research are:

- the definition of a highly adaptable information security risk-assessment and -management model based on the IT-Grundschutz framework
- the evaluation and identification of a practical knowledge management approach to relate empirical measures to subjectively estimated risk factors
- the definition of an integrated process covering continuous risk-, measure- and knowledge-management
- the design and development of a prototype to demonstrate and evaluate the practicability and usefulness of the proposed model and process

2 Model Overview

The proposed risk assessment approach uses three separate abstraction layers to estimate risks. Risks are assessed as individual protection criteria risks (e.g. confidentiality, integrity, availability risks) as well as overall for each organizational asset within the model.

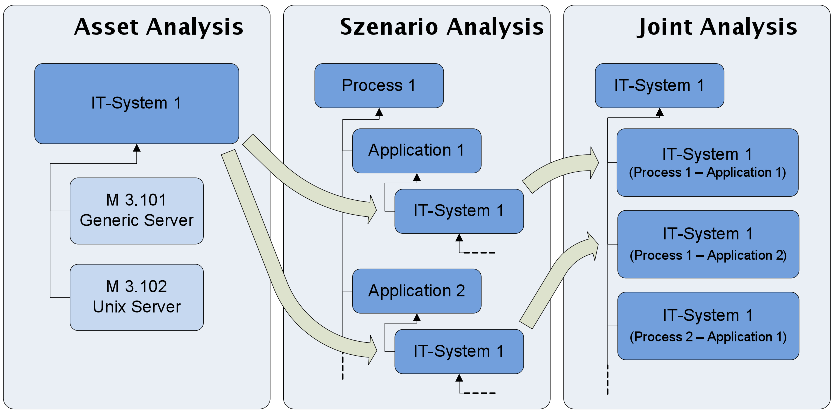

Figure 1: Separate assessment abstraction layers

The first layer provides organizational assets and their protection criteria based on IT-Grundschutz modules. If no IT-Grundschutz module is available for the asset in question, a detailed risk assessment according to [9] has to be performed. Multiple modules may be assigned to an asset to extend or specify its scope, e.g. the "Generic server" module provides generic server threats and safeguards, while the "Unix server" module extends those with Unix-specific risk factors.

The second layer allows the interrelation of those assets to assess risks using business impact analysis (BIA) and an extended fault-tree-analysis to incorporate their protection criteria dependencies amongst each other (e.g. IT system availability is dependent on the availability of the room and building it is located in, as well on organizational aspects). As the second layer is comprised of asset references, complex dependency networks can be modeled and evaluated.

The third layer provides an aggregated view of all assets, taking their different scenarios and dependencies into account. This allows a generalized view, as well as multiple scenario-specific views of any asset.

The proposed risk assessment process takes advantage of the IT-Grundschutz cross-references by allowing a threat-specific evaluation of a safeguard's maturity levels (e.g. a safeguard can be evaluated with different maturity levels against different threats scenarios), and by aiding the estimation of threat likelihoods, based on the aggregation of mitigating safeguard risks. This estimation is based on the number and importance of related immature safeguards for each threat, estimating a "baseline" threat likelihood (which can be in- or decreased depending on the organizational context) that can be minimized to zero when reaching the desired maturity levels.

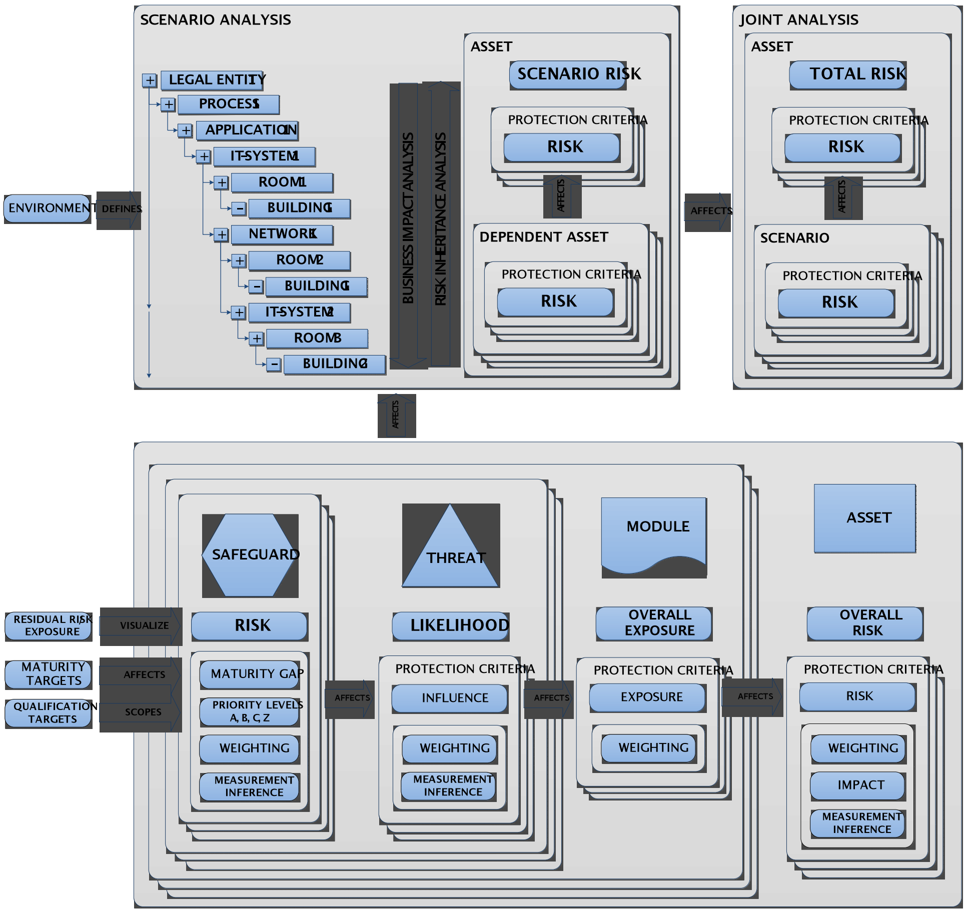

Figure 2: Overview of the proposed risk model and abstraction layers

The estimated safeguard risks lead to an increase in the likelihood of referenced threats, influencing several protection criteria. Those are aggregated at the module layer to provide a view on protection criteria exposures and overall exposure of the module. Multiple IT-Grundschutz modules can be assigned to an asset, which acts as another aggregation layer. At the asset layer, protection criteria have defined requirement (impact) levels, providing a view on protection criteria risks as well as overall asset risk.

The second modeling layer establishes the relation between assets using scenario analysis, which is also used for BIA, providing protection criteria requirement (impact) levels for scenario assets. This dependency analysis is a great instrument for business continuity planning, which can be facilitated by the proposed model by e.g. using highly granular availability requirement levels for analysis. When designing the dependency model, the level of detail can be increased repeatedly over time, focusing on high risks while minimizing time and effort. This system-decomposition follows IT-Grundschutz best practices [5], but can be extended to model and assess detailed dependencies e.g. between IT systems and support applications, taking high-availability or load balancing aspects into account.

As a last risk assessment abstraction layer, joint analysis provides a manageable way of estimating global asset risks based on the assets involvement in various scenarios. Because every asset is handled separately as a master and multiple slaves (scenarios), scenario assets can be adapted individually, allowing specific protection criteria-requirements or -exposures.

The practicability and reasonability of the approach has been tested and validated in the course of several simulations, a comprehensive risk model based on the evaluation model defined in Annex A of [1], as well as through the extensive evaluation by a unit of the Austrian Federal Ministry of Defense.

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Stefan Schiebeck holds an MSc from FHOÖ Campus Hagenberg and has several years of experience in information security and risk management. Since 2013 he is working as a scientific researcher at the Austrian Institute of Technology. While his work focuses on organizational security topics like GRC (governance, risk & compliance), including the implementation and audit of information security management systems, he also led and performed many technical security audits using the black box and white box approach, as well as multiple security architecture and concept reviews. During his work he became Certified Ethical Hacker, accredited ISO 27001 Lead and Internal Auditor as well as Certified Risk Manager. From 2007 to 2013 he was employed as Chief Information Security Officer, Internal Auditor and senior security consultant at SEC Consult GmbH. His research interests include many aspects of organizational and technical information security, with strong focus on risk assessment and management. His previous experiences in risk management concern a master thesis on the subject of risk management in cooperation with the Austrian Federal Ministry of Defense as well as multiple consulting and implementation projects in the context of risk management. He is currently in process of finishing his PhD studies at the University of Vienna.

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Information technology and supply chain resilience: a double-edged sword

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Abstract: Global supply chains (SC) have turned into intricate systems which are made of material, financial and information flows. Information Technology (IT) is frequently seen as an enabler and driver of efficient and effective supply chains that helps to connect companies with their suppliers and producers across continents and industries. The widely held view that IT has turned into a ubiquitous commodity has led to the ignorance of the increasing amounts of risks which are associated with a high dependency on IT along the whole supply chain. Analyzing supply chains as interconnected parts rather than consisting of single entities allows for a more holistic view and an assessment of the overall impact of potential SC risks. In this extended abstract we present a conceptual framework which depicts SC resilience as one of the intended strategic goals of IT deployment and which also shows unintentional implications of dependence on Information Technology.

Keywords: Supply Chain Resilience, Supply Chain Risk, Supply Chain Disruption, Cyber Risk

1 Introduction

Information Technology (IT) is prevalent in all facets of modern life, be it business or private. In 2003, Nicholas Carr claimed "IT doesn't matter", and argued that sooner or later IT would turn into a commodity without any potential for creating competitive advantage (Carr, 2003). Quite naturally, this viewpoint was heavily discussed within the academic community. Apart from the fact that many authors disagreed with his idea of IT not being able to create competitive advantage (Gilbert et al., 2012), the disregard of information technology's potential to wreak havoc to a focal company or even disrupt a whole supply chain (SC) might lead to unprecedented consequences. In this extended abstract we develop a conceptual framework showing intentions and the potential impact of IT usage on the overall supply chain.

2 IT and Supply Chain Resilience

Supply chains connect producers of raw materials via manufacturers to consumers. Modern supply chains are dynamic and complex systems which link a multitude of players and frequently span across countries and continents and even possess feedback loops, such as reverse logistics or customer response.

Resilience is defined as the ability to "survive, adapt, and grow in the face of turbulent change" (Fiksel, 2006, p. 16). Increased Supply Chain resilience has been shown to be correlated with improved supply chain performance (Pettit et al., 2013).

Information technology enables material, information and financial flows through global supply chains and the overall dependency on IT is constantly growing. A recent report from the World Economic Forum highlights the importance of potential negative implications: "cyber risk stood out as the most pressing non-traditional risk within a supply chain context, and perhaps the only issue where a seemingly small failure could cause rapid and widespread disruption" (Bhatia et al., 2013, p. 15).

3 Framework

IT is frequently seen as an enabler of SCM, providing the infrastructure which is necessary for production and collaboration. It is considered to be an indispensable tool for creating SCs which are either lean, i.e. they aim at creating cost efficiencies by effectively managing inventory, agile, i.e. they aim at being flexible by adapting to changing customer needs, or leagile, which is combining both approaches. Since companies are under increasing pressure to deliver value to their stakeholders, IT can also be utilized as a driver of SC flexibility, which allows system reconfiguration in response to unexpected factors (Bernardes and Hana, 2009), as well as to increase SC resilience, defined by Christopher and Peck (2004, p. 4) as "the ability of a system to return to its original state or move to a new, more desirable state after being disturbed".

Applying IT to optimize the supply chain leads to various potential implications. Pettit et al. (2013) differentiate between "inherent vulnerability factors and controllable capability factors" (p. 46). We propose to further distinguish between intended and unintended impact. IT is often utilized to improve a supply chain's resilience capabilities, such as efficiency, capacity or flexibility. On various occasions, unexpected synergies may arise, such as improved forecasting due to the availability of more accurate and timely data. Contrariwise, IT might also lead to increased vulnerabilities, which we also categorize into “intentional” and “unintentional”. For instance, businesses might be fully aware that the application of lean manufacturing principles to the supply chain, which is only made possible by IT, reduces vulnerability in one area, while at the same time the vulnerability of the whole system could be increased. However, companies are willing to accept some extra risk in order to capitalize on potential gains in efficiency and costs savings. The far bigger threats are those vulnerabilities which are created unintentionally, since companies may not even be aware of them, or ignore them considering their likelihood as low. Such vulnerabilities, due to their potentially serious impact and low probability of occurrence, usually are hard to quantify and prevent. Natural disasters or terrorist attacks are striking examples for those.

Figure 1 depicts a proposed framework which also includes a feedback loop from vulnerabilities back to Information Technology, indicating that IT can be used as a remedy for some vulnerabilities, while at the same time it might create a new set of vulnerabilities, which could impact an even larger section of the supply chain due to its increased interconnectivity.

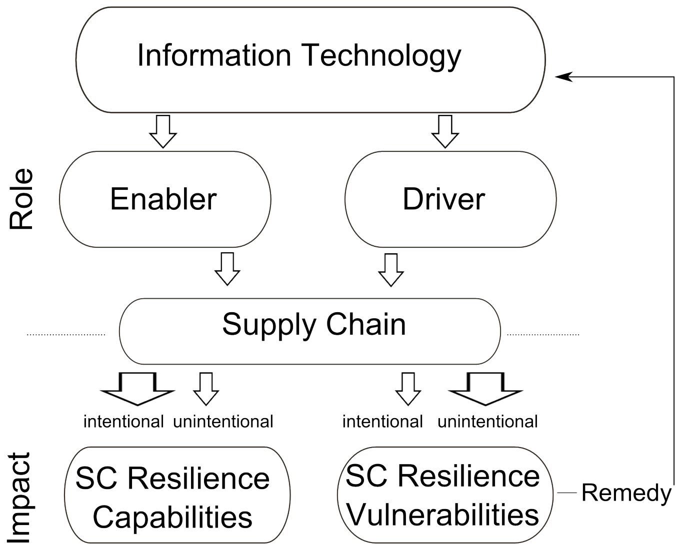

Figure 1: Framework for IT and SC Resilience

4 Further Research

The next step in our research includes the development of propositions, which can be further developed into testable hypotheses and causal models. Qualitative data will be collected and analyzed to extend and verify the proposed framework. Additionally, we will categorize the potential implications of IT-related risks according to the scale of the potential impact. To date, a general awareness about the implications of major disasters exists (Bhatia et al., 2013), but there is a lack of research which actually deals with unintentional major implications of IT usage in global supply chains.

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Employee contribution to the smooth operation of interlinked production processes

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Abstract: The aim of this work and the further research suggested herein is to contribute to the understanding of how the advancement in Information and communication technologies and their application in the field of production will affect job design and the organization of labor. In a case study we identified a specific type of work which executes primarily maintaining and problem solving activities and thus represents a key function for the smooth operation of integrated value chains.

Keywords: Industrie 4.0; work organization; Value chains; High Performance Work Systems; corrective Knowledge;

Acknowledgement: The research mentioned in this paper has been conducted in cooperation with the SOFI (Soziologisches Forschungsinstitut Göttingen), Göttingen, Germany

1 Situation

In the late 80‘s modern Information and Communication Technology (ICT) made its way into production. The new possibilities allowed continuous advancement in the fulfillment of customer requirements and a transition from mass production to small series production.
This led to the emergence of a whole array of new functions and task areas, ensuring a smooth job processing and supporting the integration of the industrial production process, such as work scheduling, material flow control, tooling, preventive maintenance etc… .
The becoming of these coordinating and maintaining functions made those fine-tuned and highly efficient production processes possible in the first place.

For the near future, some evoke the Fourth Industrial Revolution, also called Industry 4.0, which promises “Hybrid Products”, “Cyber-physical Systems” and the control and optimization of entire value creation networks in real time (Spath et.al. 2013).
Companies already today attempt the interlinking of value chains across organizational boundaries.
The consolidation of data, the adjustment of marketing and order information, production capacities and the functional interlinking of the related IT and production processes bears substantial potential for cost savings and efficiency gains.

However, in practice the operation of such integrative solutions is not frictionless, as they are always based on process models, which are simplifications by definition. These target processes only represent a standard set of events which occur in practice. But they cannot cover any occurrence possible and we can say: The more complex a process the more has to remain open. This applies even more, when it comes to the interlinking of a multitude of processes across organizational boundaries.
Contingent and unanticipated events and process deviations which had not been mapped in the standard set of variations lead to distortions, disruptions or suboptimal results. These problems have to be resolved based on “corrective knowledge” (Wallner, Gatarik, 2012) through specific interventions carried out by employees.

2 Findings

In a joint research project with a European steel producing company we had the opportunity to conduct a case study of how the interlinking of production related processes had an impact on the job design and the working conditions of the involved employees.
We identified a specific type of labor, which primarily serves to deliver this kind of maintaining and problem solving activities described above and thus represents a key function when it comes to the operational realization of integrated value chains.

This type of work work is distinguished by the following characteristics:
- Complex coordination of tasks by handling a multitude of variables
- Little to no managerial authority over other agents
- In part conflicting interests like competing for scarce ressources (e.g. production capacity)
- Extensive communication activities and room for informal agreements.

This entails, what we called “shop-floor intelligence” (Wallner, Gatarik, 2012): Swift, flexible and intelligent action adopting a broad perspective.

A descriptive sociological model of this work looks as follows:

Focus of the work	Routine-like execution, but problem anticipation and solving
Knowledge Base	Operating know-how, contacts and relations, experience, ability to access other knowledge sources
Orientation	employee consciousness
Nature of activities	Autonomous and accurate, dealing with problems and emotions, working interactively
Focus of activities	Balancing, smoothing, problem solving, keeping track
Role of superiors	Backing, balancing the work load
Organizational issues	Allow balancing, establish systemized problem solving routines, develope a positive culture of cooperation and error handling.

Accordingly the reqirements profile for employees doing this job is demanding. In addition to professional competencies these employees must feature

- Resistance to stress
- Ability to assess complex situations and the consequences of alternative action
- Social and communicative competence
- Frustration tolerance

Our case study shows, that the contribution of these employees is critical for the smooth and successful operation of interlinked production processes.

Of course, there are efforts to develop intelligent technical tool and Systems, which are increasingly capable to act autonomously, by detecting and recognizing particular events or situations and adapting accordingly including situational interactions with users or objects (ten Hompel, 2013). However we can assume, that this will increase complexity tremendously and that also in such environments corrective interventions still will be required (Hartmann, 2013).

3 Conclusion

Having determined the importance of this type of work, the question arises, what can be done in terms of education and work organization to frame this function in an optimal way.
To allow this shop floor intelligence to come into effect, employee commitment and a certain level of autonomy are necessary (Hirsch-Kreinsen, 2014)
Based on our research on High Performance Work Systems (HPWS) we suggest this approach as a frame of reference. We furthermore suggest further research on, how the principles of HPWS can applied to this type of work and what the effects would be.

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Social and technical “volatility”: commonly shared reference problem of interdisciplinary research on the energy system?

Chairs

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Modern life is full of contingency and uncertainty, the overall and overwhelming dependency on energy, especially electricity, offers a sharp contrast of impossibility and necessity. Without electricity, almost all communication will break down. Therefore, sustaining supply and distribution of electricity is mandatory. In the question on how to do this, contingency and uncertainty is re-introduced. The ongoing transformation of the existent complex of generation, transmission, distribution and consumption of energy – e.g. in the case of the German “Energiewende” – is the grand challenge right now. Specifically, the challenge consists in the paradox goal of increasing the overall efficiency in the relation of supply and demand, despite the intended re-entry of more “volatility” in the actual operations on both sides. The new envisioned paradigm stipulates close correlations between deterministic systems (like power plants, transmission lines, transformers etc.) and non-deterministic social (markets) and natural (climate, weather) systems. Volatility becomes a factor on the technical side because of the close coupling to natural processes, and on the social side because of the inclusion of more actors as operators with degrees of freedom in their actions. Both developments increase the overall complexity of the energy infrastructure and call for technical and social innovation.

List of Contributors

Christian Büscher: The “energy system”: structure, institution and operation as analytical dimensions of sociotechnical systems
Gerhard Fuchs: System transformation in the energy sector
Lea Fuenfschilling, Bernhard Truffer: The structuration of socio-technical regimes: insights from institutional theory
Rob Raven, Florian Kern, Bram Verhees, Adrian Smith: Socio-political work of sustainable technology advocates: a meta-analysis of six cases
Jens Schippl: Systems in context of the German energy transition: coping with challenges for interdisciplinary research

Roman Seidl, Manfred Paier: The diffusion of distributed electricity generation: an agent-based model of interdependent investment decisions
Patrick Sumpf: Patterns of trust and acceptance: the challenge of enabling action in emerging energy systems

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The “Energy System”: structure, institution and operation as analytical dimensions of sociotechnical systems

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Keywords: Sociotechnical Systems, Structure, Institution, Operation, Energy System

The political program of the German “Energiewende” (Energy Transition) is a dominant topic nowadays. Consequently, the transformation of the energy system has become a major research issue for various disciplines. A common theme for all disciplines is the need to clarify at least two questions: “Transformation of what?” and “Transformation into what?” Those overarching questions lead to more refined questions of what is the “Energy System”, i.e. how can we identify the unity of such a system? What are main concepts to model the energy system and what kind of problems can we identify with these concepts at hand?
One important notion in social science research is the one of „sociotechnical systems“. The term has been used in many research areas with various connotations and it indicates in as least the correlation between technical artifacts or operation on the one hand and social behavior, action, or decision-making, i.e. communication on the other. That poses theoretical and methodological challenges: First, the problem of abstractions – selecting and simplifying elements constituting a system, and, second, the problem of reductions – selecting and simplifying relations between elements. In this presentation I like to refer to three branches of arguments:

(1) Structure: Large Technical Systems (LTS) theory analyzes the historic development and the change of structures. The unity of the systems of interest is conceptualized through the reference on function and services. System boundaries and elements constituting a specific system are related to a “purpose”: providing energy, transportation, water, or world wide data exchange. The crucial argument is the assumption of emergent functions on a systems level, generated on grounds of the successful interaction (seamless) of social and technical operations. As a consequence this branch of research is interested in “breaches” or “stress” affecting the seams that hold the systems together and the governance problems which emerge as a result (Mayntz 2009).

(2) Institution: The most glaring feature of transition research is the analysis of the relation of stability (along the notions of configuration, structure, institution) and change (co-evolution, structuration, and institutionalization). Transition-research takes the argument of breaches, i.e. the non-synchronization of the constituent structures and institutions, as cause for innovational dynamics, leading to the change of dominant sociotechnical regimes or configurations (Geels 2004; Fuenfschilling und Truffer 2014).

(3) Operation: With a rather transverse argumentation, we can identify sociological research strictly distinguishing technical and social operations. Instead of a functional equivalency, the socio-technical relation is conceptualized as structural coupling of technology and communication – in contrast to operational coupling (Baecker 2011). This kind of thinking is concerned with functional problems of social systems, which are problems of relief and imposition in social relations as a consequence of technical and organizational innovation. In the theory of social systems, as Luhmann has proposed, events “which have no duration” are emphasized, because only in bringing about action, decision, i.e. communication, the system realizes its concretization (Luhmann 1995). The system is what it realizes from moment to moment. This argument highlights the need for an understanding of social mechanisms which enable actions in the face of contingency, uncertainty and risk.

In this presentation I will draw on the argument, that observing structure, and its derivative institution, is not sufficient to grasp the complexity of the energysystem. I expect the main achievement in adding the operational dimension to concepts of sociotechnical systems.

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System transformation in the energy sector

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Abstract: Based on an analysis of dominant approaches for the analysis of socio-technical system transitions, the paper will introduce a new perspective based on the theory of strategic actions fields as developed by Neil Fligstein and Doug McAdam (2011, 2012). The paper will outline the main features of the theory and will further elaborate this perspective and include thoughts on the importance of technological characteristics for successful processes of system transition. Empirical cases from the field of energy infrastructures will be used for illustration purposes.

Keywords: System transition, energy system, institutions, theory of strategic action fields, Germany

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Over the last couple of years research on socio-technical system transitions has received much interest (cp. Dolata 2013). We now know more about the functioning of markets, industrial sectors, and technological trajectories from a systems perspective. Most of the reflections using systems vocabulary are informed by institutionalist thinking and analyze predominantly more or less stable structures (Mayntz 2004). Research has been concentrated on the more static-structural aspects. Most of the relevant literature is thus focusing on the internal functioning of systems and presupposes that they are working more or less in a self-sufficient manner. The implication of specific systems logics or institutional logics in our mind stresses too much the issue of consensus, too much agreement about what is going on in a field. It pays less attention to actors' positions, the creation of rules in a field that favor the more powerful over the less powerful, and the general use of power.

At least as important therefore is the challenge to analyze the *change* of existing structures and systems. It has been discussed sufficiently that structures, institutions as well as organizations have a specific inertia. Path dependence - among other factors - plays a significant role in making more radical change difficult. Institutionalist and evolutionary studies have repeatedly and successfully attempted to show that changes especially of a fundamental nature will be the result of "external" demands (Meyer/Rowan 1977) or major crisis and shocks emanating from the environment of a field (Gould 2002). Fundamental changes are not driven forward by the incumbent actors in a specific field, sector, organization or policy domain, but by challenger groups. The transformation of a field is linked with the successful realization of radical innovations as opposed to incremental innovations. To offer a tentative distinction: incremental innovations improve on existing ways (i.e., activities, conceptions, and purposes) of doing things, while radical innovations change the ways things are done. Under this definition, the key to classifying something as a radical innovation is the degree to which it reverberates out to alter the interacting system of which it is a part.

A good example to illustrate this represents the energy sector. The development of the energy sector in the past had been determined by a small group of industrial actors along with political and regulatory decision makers (Viktor 2002). It is a prime example of a large technical system. In many countries decisions on the use of specific technologies (e.g. nuclear energy, renewable energies) have not been the result of the activities of optimizing system actors. The essential incentives for changes in the energy sector have come from the so called oil-price shocks in the mid ninety-seventies of the last century, the Chernobyl accident and the resulting critical attitude towards nuclear energy in many countries, the liberalization of markets driven forward by the European Commission and finally the Fukushima catastrophe. In other word incidents external to the system under investigation.

Such external events can - under specific conditions, which need further analytical specification and empirical research -, lead to changes in the governance structure. The standard operating procedure surely is to have the incumbent actors deal with external challenges in the established way of doing things (structures and actors). We assume that changes in the governance structure are not an immediate reaction to external shocks, but rather these external shocks have to be interpreted, mediated by new, skilled actors and seen as a chance to see things differently and organize and build coalitions around these new ideas of how things could be done differently. In order to be successful, a change in the relevant power constellations which supports the governance structure is required. Processes of change deal with the question, who gets what under what conditions.

An explanatory perspective, which would allow us to better understand such processes, is the evolving Theory of Strategic Action Fields by Neil Fligstein and his collaborator (Fligstein/McAdam 2011), which we will try to employ in the following as a basis for our discussion of changing and/or stable governance structures in the energy sector and its consequences for the success of implementing new technologies.

If we want to discuss systemic change, it will be useful to distinguish between the analytically available outcomes of such processes. We can distinguish between the following alternatives for the development of a system as a reaction to external challenges:

1) A re-imposition or continuation of the old system with minor **adaptation**s.
2) A breakdown of the incumbent structure and **dissolution** into unorganized social space.
3) A further **differentiation** of the system (e.g. development of sheltered niches, new sectors).
4) The coming into existence of a totally new system (**transformation**).

We claim that incumbent actors will always try to defend the status quo. It follows that if a new system structure is supposed to emerge, it will be based on ideas and interests coming from invader or challenger groups. They will attempt to create new rules and a new order and therefore either will build a new political coalition based on their common interests and will create a new cultural frame that reorganizes interests and identities. The paper will bring this conceptual apparatus to the analysis of energy transitions and especially highlight the role of technological characteristics in process of successful organizing for transition processes.

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The structuration of socio-technical regimes: conceptual foundations from institutional theory

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Abstract: In recent years, socio-technical transitions literature has gained importance in addressing long-term, transformative change in various industries. In order to account for the inertia and path-dependency experienced in these sectors, the concept of the socio-technical regime has been formulated. Socio-technical regimes denote the paradigmatic core of a sector, which results from the co-evolution of institutions and technologies over time. Despite its widespread acceptance, the regime concept has repeatedly been criticized for lacking a clear operationalization. As a consequence, empirical applications tend to depict regimes as too 'monolithic' and 'homogenous', not adequately considering persistent institutional tensions and contradictions. These are however crucial for assessing transition dynamics. In this paper, we revisit two concepts from institutional theory that enable an explicit identification of socio-technical regimes and more generally a specification of the 'semi-coherence' of socio-technical systems. First, we will show that 'levels of structuration' can be conceptualized as degrees of institutionalization, thereby treating institutionalization as a variable with different effects on actors, the stability of the system and thus the potential for change. Secondly, we draw on the institutional logics approach to characterize the content of various structural elements present in a system and to trace conflicts and contradictions between them. We illustrate this approach with an empirical in-depth analysis of the transformation of the Australian urban water sector since the 1970ies. The corresponding Paper is in press: Lea Fuenfschilling, Bernhard Truffer, The structuration of socio-technical regimes—Conceptual foundations from institutional theory, Research Policy, Available online 14 November 2013, ISSN 0048-7333, http://dx.doi.org/10.1016/j.respol.2013.10.010.

Keywords: Sustainability transitions, multi-level perspective, socio-technical regime, institutionalization, institutional logics, Australian urban water sector.

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Socio-political work of sustainable technology advocates: a meta-analysis of six cases

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Abstract: The paper contributes to current theory on protective space by showing the complex and messy nature of 'outward-oriented' socio-political work necessary for creating and maintaining protective space for sustainable technologies. In the sustainability transitions literature the idea of 'protective space' shielding niche innovations from unfriendly selection environments is a fundamental concept. A lot of work has been done to conceptually and empirically explore the effects of such protection on niche developments. However, few analysts have paused to consider how and by whom such protective space is created, maintained or expanded. The agency required of sustainable technology advocates in such processes is currently underexplored in the literature. Our paper addresses this gap by conducting a meta-analysis of six sustainable technology case studies across two different countries (UK and the Netherlands) which have been conducted using the Smith and Raven (2012) framework of conceptualising 'protective space' as consisting of shielding, nurturing and empowering processes. This paper deepens this framework by developing four propositions about the ways in which technology advocates try to create, mobilise and maintain protective space for their preferred sustainable technologies. These propositions are confronted with empirical evidence of the six case studies. The paper concludes that all propositions are confirmed, but that the cases add substantial nuances to each of them.

Keywords: protective space; niche; politics; sustainability transitions; technology advocacy

Acknowledgement: This research was kindly supported by ESRC in the UK and NWO in the Netherlands

1 Background and research question

A key understanding in the literature on sustainability transitions is that incumbent systems of production and consumption need to fundamentally change in order for more sustainable technologies to become widely adopted (Markard et al., 2012). Consequently, research in this field has tried to understand where and how these new sustainable technologies emerge and scale-up (Kemp et al., 1998). The niche concept has been deployed to denote a wide variety of 'spaces' for initiating new sustainable technology development such as R&D settings, geographical locations, NGOs and environmental user groups and grassroots communities. This paper aims to make a contribution to this particular literature.

The niche concept has been most prominent in the Multi-Level Perspective (Rip and Kemp, 1998) and Strategic Niche Management literature (Schot & Geels, 2008). Until recently, however, analysis has rarely paused to consider how protective spaces are created, maintained and, if at all, removed. Spaces have tended to be taken as given, and analysis focused on the development of technological expectations, actor networks and social learning processes that nurture technological development within those spaces. In response to this gap Smith and Raven (2012) developed a framework which conceptualises 'protective space' as consisting of three processes: shielding, nurturing and empowering. The aim of this paper is to deepen that framework by developing four novel propositions regarding the ways in which technology advocates mobilise and maintain protective spaces. We address the following question:

How do technology advocates attempt to create, maintain and expand protective space for developing their technologies?

We conduct a meta-analysis of case studies of three different types of technologies that are being promoted for decarbonising electricity generation in two jurisdictions. The technologies are solar photovoltaics (PV), offshore wind (OSW), and carbon capture and storage (CCS). We explore how spaces for their development have been constructed in the UK and the Netherlands.

2 Propositions

In an earlier review of the niche literature, Smith and Raven (2012) focused specifically on the construction of protective spaces. They found the literature emphasised two out of three features of protective spaces important to the development of sustainable innovations. These functional features were *shielding* and *nurturing*. A third function, that of *empowering* the niche innovation, was less developed in the literature. Niche spaces protect through *shielding* in the sense that they provide sites for technological development relatively free of the selection pressures that prohibit such activity more generally elsewhere. Shielding can be passive in the sense that favourable spaces already exist before and independently of the strategic action by technology advocates such as environmentally concerned user groups Protective spaces can also be created more actively, through the purposeful provision of facilities like demonstration programmes or strategic firm investments.

P1: Path-breaking sustainable technology development requires advocates to mobilise protective spaces.

P2: Technology advocates mobilise pre-existing passive spaces initially before strategically creating dedicated active spaces.

The measures generating spaces for innovative activity can also contribute to the second feature of protective spaces, which are the processes for nurturing the innovation. However, it is the way shielding and nurturing processes are complemented by empowerment of the niche innovation where the literature is least developed. Smith and Raven (2012) draw a conceptual distinction between 'fit-and-conform' empowerment and 'stretch-and-transform' empowerment. 'Fit-and-conform' empowerment relates to those processes making a niche innovation more competitive within unchanged selection environments. In contrast, 'stretch-and-transform' empowerment seeks influence in the way the niche innovation might change prevailing selection environments.

P3: Fit-and-conform strategies are more likely to occur than stretch-and-transform strategies.

Smith and Raven suggest that narrative and networking work undertaken by technology advocates is central to empowerment. Narratives bridge positive expectations about the technology, drawing upon inward-oriented work, with outward-oriented critique of incumbent regimes and identification of institutional opportunities for realising technological promise. So there is work to be done in committing actors in the wider social world to the technology development. Advocates enroll these commitments through the narratives that align socio-technical development to broader agendas (Geels and Verhees, 2011).

P4: To successfully secure resources for niche development, advocates need to link socio-technical narratives to prominent socio-political agendas, and enrol powerful actors into their network.

3 Results and conclusions

Table 1 provides a summary of the results.

Proposition	Results
P1	All sustainable technology cases analysed in this paper have required substantial protective space. However, the existence or creation of such spaces does not automatically lead to wide-spread sustainable technology deployment if they are not sustained, commercial interest is low or if existing rules need significant changes.
P2	The exploitation of passive niche spaces mostly precedes the creation of more active spaces, though arguably cases that are mostly policy-driven like CCS may exhibit a pattern of more active creation of spaces from the beginning. A qualification is that when one takes a more international perspective, even CCS was applied in more passive spaces in the beginning.
P3	Our cases show evidence of fit-and-conform strategies more so than stretch-and-transform. This is due to the more powerful technology advocacy needed for the latter compared to the first.
P4	Shielding, nurturing and empowerment may produce virtuous cycles to create momentum between low-carbon energy innovations, but this depends on the ability of niche advocates to align their narratives with wider socio-political agendas.

This paper has a number of implications for niche theory. First, the existing niche-literature has highlighted the range of socio-technical configuring that technology advocates undertake, such as improving technological and economic performance, developing markets, building new industries and developing required infrastructures. This paper shows that next to this internal, system-building oriented work, a tremendous amount and variety of a second type of work of technology advocates is needed, i.e. outward-oriented, socio-political work.

Second, the shielding, nurturing and empowerment framework highlights the importance of narratives as key devices in undertaking this socio-political work. In our cases, these narratives mostly emphasise a fit-and-conform development of the innovation. To a lesser extent, we have also found evidence of other kinds of narratives, foregrounding ecological and social concerns and highlighting the need for substantial stretch-and-transform institutional reforms.

Third, whether or not these narratives get traction among potential providers of protective measures of those in charge of institutional reforms also depends on other factors. Our cases suggest narratives are powerful depending on the historical and material evolution of a niche and the micro-politics and –strategies that technology advocates engage in (Jorgensen, 2012). T

Fourth, these micro-politics and –strategies include but are not limited to the capabilities and skills to lobby for resources among public and private actors, to provide evidence for positive technology and market expectations, to link a technology to broader socio-political agendas, to strategically negotiate the content of protective measures, to engage in public debates in the media and to successfully engage local and regional stakeholders.

Fifth, what emerges is a picture of protective space not as a straightforward, linear installment of well thought-through shields, which allow a subsequent nurturing and empowerment of sustainable innovations, but rather a messy reality of incoherent, sometimes conflicting and incomplete protective space dynamics in practice. There is no linear or systematic development of shielding, nurturing and empowerment visible in our six cases. Partial and incomplete shields generate location-specific nurturing processes that need to fulfill requirements inscripted in those shields, which may include promises as diverse as job creation, technology efficiencies, economic performance, greener development, export opportunities and so on. Empowerment rests on the ability to deliver on those promises, or at least keep up the level of promises.

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"Systems" in context of the German energy transition: coping with challenges for interdisciplinary research

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Abstract: Interdisciplinary and transdisciplinary research is needed to support the transition of socio-technical systems such as the energy system. But different disciplinary traditions may lead to different understandings on what the energy system is. Such concepts of systems are implicitly formative for the perception of problems and for the design of projects. Based on experiences made in an interdisciplinary energy project, this contribution will highlight the challenges of integrating different perspectives on the energy system. The potential of defining commonly shared reference problems for overcoming these challenges will be discussed.

Keywords: socio-technical systems, transition of systems, Energiewende, interdisciplinary research

It is widely acknowledged that a transition of modern infrastructures towards more sustainability is needed to cope with future challenges in fields such as energy, transport, water or telecommunication. The term “system” is commonly used in context of such infrastructure transitions. However, as it will be shown in this contribution, different disciplines and approaches seem to differ in their understanding about what the energy system or the transport system exactly is. This has consequences for interdisciplinary research activities, as will be illustrated with the example of the project ENERGY-TRANS that aims at informing the German energy transition “Energiewende” by setting its focus on the demand side of the energy system.

Germany decided to transform its energy system in a relatively short period which includes an accelerated phase-out from nuclear power, a rapid expansion of renewable energies as well as an ambitious increase in energy efficiency. A broad range of visions and concepts exist which outline potential future designs of such a transformed energy system as well as pathways on how to get there. In general such future oriented studies concentrate on the technical requirements for rebuilding the energy system (Poganietz et al. 2013).

However, energy systems are not only a mixture of technologies and infrastructures; they are socio-technical system (Verbong and Loorbach 2012). The term exemplifies that a transition of the energy system is more than the substitution of old technologies by new ones. The interfaces between technologies and society are affected as well, the relationship between actors (including users) with their motivations and behavioral patterns, institutions and technologies will also have to be transformed (Schippl 2013). It is argued that a co-evolution between the different elements of the system is required to achieve a transition (Geels 2005). Accordingly, a broader perspective on the “system” is needed to capture these heterogeneous set of factors and interrelations. Research that tries to address the energy transitions and to support its governance needs to cope with a high degree in complexity.

The various questions and challengers of the energy transition can hardly be tackled by on single discipline; interdisciplinary or even transdisciplinary research is needed that is not only inspired by the provision of disciplinary knowledge but also by finding solutions for complex societal problems – problems, which are often not following the disciplinary routines for perceiving problems. It is further argued that not only different disciplines but also different kinds of knowledge are needed for the governance of the energy system: at least it can be differentiated between “system knowledge” for understanding how the system works, “orientation knowledge” for understanding the role of societal norms and values, and transformation knowledge for understanding, e.g., the effects, efficiency, acceptability of polices or measures (see Grunwald and Schippl 2013).

However, in particular in highly interdisciplinary consortia there is the challenge that concepts of systems are implicitly formative for the design of projects. This may lead to inconsistencies in methodological approaches as well as to barriers in terms integration of results of different projects. For example, the question can be raised if socio-technical systems should be considered as one “unit” or rather as the coupling of two (a social and a technical one) or even more systems or subsystems. Some authors may prefer the first perspective whereas the metaphor of the transformation of the “interfaces” or, even more, the co-evolution between the social and the technical might suggest that also the second options can be useful.

Against this backdrop, this contribution will deal with the need for inter- and transdisciplinary research on the transition of complex infrastructure systems and with the challenges to cope with diversity on systems-concepts in interdisciplinary co-operations. It will further highlight the need to explicitly expose a common reference problem for the integration of different strands of research and for enabling useful recommendations to policy makers. It will be discussed to what extent “volatility” and the related tension between flexibility and stability of the systems components and/or the environment of systems may serve as such an integrative anchor for interdisciplinary research on the energy transition.

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The diffusion of distributed electricity generation: An agent-based model of interdependent investment decisions

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Abstract: An important element of a future low-carbon electricity system is small-scale distributed production of renewable energy. In this paper we explore the transition from traditional centralized electricity distribution systems towards distributed systems of electricity production and consumption. We focus on the self-organization of consumers who become producers ("prosumers") to provide such a distributed production system under different policy scenarios. Self-organization results from mutually dependent investment decisions of inter-related actors.

We adopt an agent-based simulation approach to analyse the possible build-up of such a system. Households as agents decide upon investment into small- and medium renewable energy generation. Decisions upon possible investment options are based on individual preferences, social interaction, regulatory constraints and the limits of a power grid. Other relevant actors (energy suppliers, network operators, regulatory authorities, government agencies) are considered as exogenous factors.

The model allows for simulation experiments to explore different policy options, e.g. feed-in tariffs, public provision of extended grid capacity, investment subsidies or awareness measures. Thus, the model contributes to a better understanding of policy effects on the socio-economic feasibility of the energy transition related to renewable electricity production.

Keywords: Energy transition, investment, distributed generation, agent-based modelling, energy policy

Acknowledgement: The work presented here results from an internal research project at the AIT and an ongoing PhD project (R.S.) within the joint doctoral program of AIT Innovation Systems Department and the Institute of Systems Sciences, Innovation and Sustainability Research (ISIS) at Karl-Franzens-Universität Graz. R.S. is greatly indebted to his PhD supervisor Manfred Füllsack (ISIS), and both authors acknowledge fruitful discussions with project colleagues from AIT, especially Michael Barber, Alexander Kaufmann, Doris Schartinger and Klaus Kubeczko.

Background and context

Small-scale distributed production of electricity from renewable sources is considered a core element of a future low-carbon energy system. Through smart electricity grids, small-scale distributed electricity production offers the potential for lower cost, higher service reliability, increased energy efficiency and energy independence. Thus, smart electricity grids are widely accepted as key enabling technologies for renewable electricity generation at a significant level. Although there is still considerable uncertainty regarding the desired features of smart grids and their technical feasibility, we argue that socio-economic factors furthering or hindering smart grid deployment are still more ponderous. In the last couple of years, the core driver of smart grid deployment in many countries has been the investment into distributed production, mainly through small-scale PV installations and wind farms, triggered by different policy interventions.

At the core of the distributed investment process is a social process of actor involvement and participation. This process can be seen as one of self-organization of consumers who become producers ("prosumers") and collectively provide such a distributed production system. Self-organization on this level of consideration results from the fact that the investment decisions of the actors are strongly interdependent – related with various aspects of physical and social proximity, as well as from technical constraints. Thus, embeddedness in a certain neighbourhood is expected to strongly influence the investment behaviour of households. From a complex systems perspective, investment into distributed energy production can be interpreted as an (endogenous) innovation-diffusion process under (exogenous) political and economic framework conditions.

The objective of the research presented here is to analyse the dynamics of innovation diffusion by means of complex systems analysis, and to identify empirically based pathways for the energy transition, focusing on investment into distributed renewable electricity production. The final goal of this endeavour is to explore different policy options supporting this transition, e.g. feed-in tariffs, public provision of extended grid capacity, investment subsidies or awareness measures.

Understanding the adoption process

Methodology

As we see the process as one of the self-organisation of inter-related actors we need a methodology to observe such a process. Thus we adopt an agent-based modelling (ABM) approach. This allows us to inquire into the spatio-temporal build-up of such a process considering various assumptions about the investment behaviour and its determining factors. Furthermore ABM allows considering the effects of heterogeneity of actors, something that is expected to be of relevance when it comes to the adoption of small scale renewable production.

Adoption

Technology adoption can be determined by various factors. At the core it is one of rationality. Consumers may decide upon attitudes and norms, deliberation and social influence. Furthermore there may be technical or structural restrictions, as one needs a possibility to install a production device and the possibility to connect to the grid.

We model actor decisions as a two-step process. The first step considers if the agent is being restricted by constraints like budget constraints or technical possibility. The second step is deciding if one of the possible investment options fits the needs of the actor. This is calculated in a utility-based process. The process considers two possible states: adoption or non-adoption. There is a utility for non-adoption (e.g. the amount of money saved by refraining from investment) and a utility for investment (e.g. the amount of money the device is expected to return within its lifetime). If the utility of investment supersedes non-investment, the actor will decide to adopt.

To allow for the consideration of heterogeneity of actors we assume two possible basic rationales of actors deciding upon investment. Agents may be idiosyncratic or utility maximizing. Idiosyncratic actor's decisions are based on set reservation prices; the second one is based on deliberation. Reservation prices are chosen to reflect set attitudes of actors towards investment into renewable energy production regardless of its economic value to the actor. Attitudes may be positive, resulting in investment even despite of negative returns on investment reflected by high reservation prices or negative which is reflected by low reservation prices. Utility maximizing actor's decisions are based on deliberation. They compare the expected returns on investment for different devices with their investment cost.

Finally as we see the process as one of self-organization interaction of actors matters. Investment decisions are influenced by the investment decisions of inter-related actors. This assumption is reflected by applying the pattern of a diffusion model (Laciana et al., 2013).

Table 1 summarizes the investment decision model. Beyond the individual and neighbourhood factors discussed, a global influence factor reflecting global buzz such as information or global attitudes is added.

Table 1: Utility based investment decisions

Utility	u_i Individual economic investment calculu	willingness to	u_n Neighbourhood	u_g Global
Investment	$u_+ = {}^{n}\sum_{t=0} (R_{E,t} + C_{E,t} - C_{O,t}) / (1+i)^t$	$u_+ = B * r_w$	$u_+ = n_+$ number of adopters	
Non-Investment	$u_- = I$ Investment Cost		$u_- = n_-$ number of non-ad.	
Normalized	$\Delta u_i = (u_+ - u_-) / \max(u_+ ; u_-)$		$\Delta u_n = (n_+ - n_-) / \max(n_+ ; n_-)$	Δu_g [-1;1]
Total	$\Delta u = (1 - \alpha - \beta) * \Delta u_i + \alpha * \Delta u_n + \beta * \Delta u_g \quad \dots \quad \alpha + \beta \leq 1$			

n ... device lifetime
R_E ... returns on energy sold
C_E ... cost of energy not purchased due to own production
C_O ... cost of operation
i ... interest rate
B ... budget
r_w ... willingness to pay rate
α ... neighbourhood influence factor
β ... global influence factor

The resulting model is a diffusion model that can be tested as an Ising-like model in cellular space to test for validity and a reasonable parameter space reflecting adoption processes. Figure 1 shows an example of such a test-case in cellular space. At a later stage the model will incorporate a deeper account of physical and social space as well as technical restrictions.

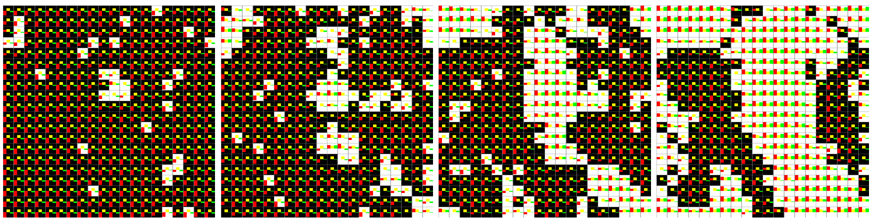

Figure 1: Patterns of Investment Diffusion in Cellular Space

Policy experiments

Besides understanding the adoption process from the bottom-up the model allows for a better understanding of how factors governing the process influence adoption behaviour. Thus we aim at a better understanding of possible policy impacts. The model is able to reflect various policy options. Feed-in tariffs will increase returns on investment and thus foster investment for those who consider returns in a process of economic deliberation. Investment funding may reduce investment cost and thus foster possible investment for all actors. Information and promotion campaigns may increase the influence of global buzz and increase the share of idiosyncratic actors. Finally investment in grid infrastructure will allow more actors to consider investment.

Results

Developing and testing a model on small scale investment into renewable energy production allows to identify essential elements of the process that have to be considered for understanding diffusion dynamics. Furthermore typical policy scenarios can be tested for their impact on the diffusion process. Thus insight into the essential elements of policy oriented on fostering a possible transition towards distributed small scale energy production can be given. Such insight will foster debate about the essential elements and dynamics of the process on the prosumer level as well as on the policy level.

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Patterns of trust and acceptance: the challenge of enabling action in emerging energy systems

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Keywords: Trust; Acceptance; Energy Systems; Mechanisms of Enabling Action

Scientific and public debates on emerging energy technologies alike are dominated by the paradigm of "public acceptance" (Kasperson/Ram 2013) as the central social challenge of energy system transformation. Among the aspects discussed is acceptance of new technologies, facilities, grid extensions as well as economic or legal facets that accompany these technological changes. Increasingly, issues revolving around quantities and qualities of trust in technologies and involved actors (Hardin 2013) are mentioned in the same connection as companion of acceptance. Nonetheless, their relation is often left largely unspecified, though precisions in this area could provide many benefits (Todt 2011). The suggested presentation, therefore, wants to present interrelations and differentiations between the terms acceptance and trust exemplified by the German Energy Transition. The conceptual clarification between trust and acceptance helps to circumvent conventional wisdom regarding functions and consequences of the frequently requested "technology acceptance" surrounding public debates on energy policies in countries such as Germany or the US. To this end, the aim is a specification of the relation between both phenomenon and the inference of consequences for both practical and research foci on socio-technical transformations. Consequently, I refer to the "operational dimension" of transition analysis described by the symposium on "technical and social 'volatility' -commonly shared reference problem of interdisciplinary research on the energy system?". I explicitly address trust as a mechanism of "uncertainty absorption" that triggers action and decision-making, illustrated by emerging smart grid developments.

Starting from a historical point of view, a demand for decision-making and a sharp rise in reflexivity among end-users of electricity (households, commerce, industry) in the future grid are at high probability of increasing compared to the status quo and earlier periods of electricity consumption. One distinct feature of smart grids, for instance, is the application of "smart meters", enabling two-way communication between consumers and suppliers, provoking active consumers often termed "prosumers". Thus, to facilitate the smart future grid, formerly passive consumers are supposed to play a critical role by adapting their energy consumption behavior through smart meters and becoming engaged in energy trade with self-generated electricity, for example. The idea is to involve consumers in maintaining electricity availability through efficiency incentives, but also serving the purpose of "grid-supportive" measures required to secure grid stability and security of supply in the face of renewable energy volatility. Even against expectations of partial decision delegation towards software agents in smart meter appliances in order to mitigate a constant occupation of consumers with electricity management (Ramchurn et al. 2012), the decision to delegate one's decision obviously requires itself decision-making and growing attention. Consequently, formerly latent background processes (permanent, undoubted supply of electricity) are likely to turn into continuous manifestation, triggering management by consumers. This development could be described as a qualitative change in the underlying prerogatives of the future energy domain. Accordingly, I would argue that an active trust in technology (smart meters), markets (reputation management) and organizations (supervision, trust intermediaries) is indispensable for the future energy system to work as envisaged, considering the massive revaluation of single decentralized consumption and feed-in units in particular.

Notably, past energy consumers could be afforded to distrust the energy system and/or its concomitant technology (e.g. nuclear plants) without much of an overarching, systemic consequence – the future grid, due to its possible dependency on the “appropriate” energy behavior of single users, is likely to be vulnerable to cumulated effects of massive simultaneous actions of electricity customers outside the expected behavioral patterns envisaged by smart grid proponents, for instance. With the broad-scale rejection of E10 biofuel, for instance, the German public has recently observed the emergent power of collective consumer distrust (d'Arcy Hughes 2011). In accordance with the main focus of the conference, the contribution aims at unraveling some implications of smart grid technology programs from a systemic perspective, which involves a special relevance of functions, premises and consequences of “system trust” (Luhmann 1979).

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III B
Professional systemics

Chairs

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The Symposium's aim is to stimulate an energetic exchange of systems approach perspectives in the area of Professional Systemics applied effectively in organizations and enterprises across a wide spectrum of both service and production industry sectors. The traditional organization is designed along a hierarchical structure in which activities are organized along common areas of responsibility. Key processes are defined and controlled within strict functional boundaries, with minimum attention given to systemic interaction. Business decisions are derived through analytical methods which involve the determination of the meaning of what is studied in the context of a reductionist approach: reducing the whole into its constituent elements, understanding each element separately and aggregating understanding of the individual elements into an understanding of the whole. Given the dynamic complexity of the today's business environment and the continual exchange of its constituent elements, application of the reductionist method typically results in the loss of the essential properties of both the system studied as well as of its parts. Hence, business decisions lack cohesion, and management lacks the ability to align activities to effectively achieve the company's long-term strategic objectives. Systems thinking is fundamentally different from the reductionist method in that it focuses on the understanding of how and why various elements affect one another within a defined unified whole. A systemic approach concentrates on the understanding of the interactions of the constituent elements of a system that produce a behavior rather that the desegregated parts of the system, studied in isolation. The need for a systemic approach has never been more imperative, given the realities of the new economic climate impelled by the current credit crisis and the need for organizations to challenge existing paradigms, core values and business assumptions against the dynamic complexity of a volatile economic environment.

List of Contributors

Nikitas Assimakopoulos, Stergiani Giannakou, Dimitrios Varsos: A systemic approach towards green pharmaceutical manufacturing in order to minimize the impact of pharmaceutical production on the environmental contamination.
Nikitas Assimakopoulos, Alexandros Miaris: Viable process systemic multi-methodology: VIPROCE
Nikitas Assimakopoulos, Dimitrios Varsos: Developing the dynamic layer within the design and control systemic methodology: DCSYM-2

Patricia Bertin: Dynamics of agricultural knowledge production: learning from a systems thinking perspective

Janos Korn: Fundamentals and implications of systems science

Lundy Lewis: Professional systemics applied to the development of social skills in children with autism spectrum disorder: a case study

Aristea Sinanioti: Personal data protection in the electronic communications sector

Panayiotis Vlassis, Michaela Theiler: Energiaproject case study: how far can innovation be pushed in the real market?

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A systemic approach towards green pharmaceutical manufacturing in order to minimize the impact of pharmaceutical production on the environmental contamination

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Abstract: In the present study a systemic approach to the impact of pharmaceutical manufacturing and production on the risk of environmental effects as well as on human and animals is presented. Nowadays, pharmaceutical companies are called to take initiatives to minimize the use of potentially hazardous substances in producing Pharmaceutical Products, reduce the generation of waste and operate in other environmentally friendly ways. In addition, EU legislation is required to acknowledge that the pollution of waters and soils with pharmaceutical residues is an emerging environmental issue. Towards these goal legislative and no legislative systemic measures are proposed involving all interested parties (i.e. pharmaceutical industry, EU Member states, European Commission, healthcare professionals, citizens) in order to achieve pharmaceuticals' production which is environmentally, economically, and socially defensible wherever in the world it occurs..

Keywords: Systems Approach, Public health, Environment, Good Manufacturing Practice (GMP), Green manufacturing.

1 Study background

In recent years our understanding of the interaction between health and the environment is gaining ground. A safe environment is a precondition for good public and animal health. Although, the pharmaceutical industry of the European Union maintains high standards of Quality Management in the development, manufacture and control of medicinal products, it is also a highly developing sector which apart from offering to patients safe, qualitative and efficient Pharmaceutical Products contributes through its operating activities to environmental contamination. Taking under consideration that Pharmaceutical Products, their active ingredients as well as their excipients, metabolites and residuals are highly active substances and that they are consumed in high amounts, becomes evident that risks to environment due to the quantity and quality of their emissions during their life cycle are raising. Drug residues of various categories (hormones, anti-cancer, antidepressants, antibiotics, etc) have been detected in all environmental compartments, including sewage, surface water, groundwater, soil, air and biota.

Therefore, nowadays, pharmaceutical companies need to take bold initiatives to minimize the use of potentially hazardous substances in producing Pharmaceutical Products, reduce the generation of waste and operate in other environmentally friendly ways. In addition, EU legislation is required to acknowledge that the pollution of waters and soils with pharmaceutical residues is an emerging environmental issue. It calls upon the European Commission, based inter alia, on data received from the European Pharmaceuticals Agency, the European Environmental Agency and the EU Member States, to insert regulations for environmental control among pharmaceutical production regulations.

2 Objectives of the study

In the present study, the scale and the trends of the described issue are presented from a systemic perspective. Systemic interaction of the legislative and non-legislative factors influencing the issue is deployed. European Commission has adopted Directives laying down principles and guidelines of Good Manufacturing Practice (GMP) for medicinal products. Detailed guidelines in accordance with those principles are published in the Guide to Good Manufacturing Practice, which will be used in assessing applications for manufacturing authorizations and as a basis for inspection of manufacturers of medicinal products. The goals of the study are to understand if the environmental and health issues related to the presence of Pharmaceutical Products in the environment are considered in the current legislation and current practice and to identify options to ameliorate the current framework and discuss their feasibility.

Today a considerable share of pharmaceutical manufacturing and production of starting materials and semi-products takes place in low-cost countries, and many large companies plan to locate even more of their production there. In the first decade of the 21st century, research findings have revealed emissions from the manufacturing of medicinal products in India on a scale that can seriously impact the health of humans and animals, as well as the environment. Against this background, emissions of pharmaceutical substances from drug production in the third world are an urgent matter.

Anyone granted authorization to manufacture medicinal products must comply with a number of requirements under current legislation. One of these is to conform to the principles and guidelines of Good Manufacturing Practice, GMP, for medicinal products, thereby using as starting materials only active substances that were produced in accordance with detailed guidelines for good manufacturing practice for starting materials. Good manufacturing practice is a component of the quality assurance that is intended to make sure that the products are always produced and monitored in such a manner that they satisfy quality requirements that are appropriate for their intended use. Manufacturing authorization will be revoked if, for example, GMP is not observed.

3 Proposals and Measures

By inserting the regulations for environmental control among production regulations within the framework of GMP, legislation will also have an impact on third countries. A further advantage of placing environmental requirements within GMP is that there is a well-developed and well-functioning inspection system for monitoring manufacturing and GMP. By placing environmental requirements within the framework of GMP, inspection rules will also apply to checking that environmental requirements are being observed. In this way, the gap between theory and practice towards green manufacturing could be bridged.

Additionally, systemic measures are proposed (including all interested parties: pharmaceutical industry, EU Member states, European Commission, healthcare professionals, citizens) in order to achieve the objective of sustainable development for Pharmaceutical Products, thereby attaining production that is environmentally, economically, and socially defensible wherever in the world it occurs. These measures include legislative and no legislative solutions such as implementing economic instruments, developing the concept of green pharmaceuticals and adapting packaging to influence consumption, harmonizing the implementation of collection schemes, developing source separation and wastewater treatments, actively involving public society and professionals through information and education, building existing knowledge, ensuring reporting transparency and facilitating access to information, changing paradigms in risk assessment: developing a monograph system based on active product ingredients, improving governance and building upon eco-pharmacovigilance, and implementing economic instruments.

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Viable process systemic multi-methodology: VIPROCE

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Abstract: The viable system model (VSM) of Beer is presented by examining its effectiveness in practice using a different and structured design. To support better viable systems, we deliver briefly the design and control systemic methodology (DCSYM) in strategic and procedure level. The conceptual environment of VSM within DCSYM will be presented as 'VIPROCE' systemic multi-methodology using the principles of total systems intervention (TSI) methodology. In the new viable and operational system we analyze organizational structures in strategic and procedure level where control and meta-control systems are used for decision and meta-decision making along with a process drawing tool.

Keywords: systems approach; viable system model; VSM; design and control systemic methodology; DCSYM; total systems intervention; TSI; meta; process modeling; VIPROCE

1 Developing a methodology

Beer's VSM, is an excellent strategic asset and describes an enterprise with utmost efficiency in its more general aspects. However, when it comes to task management and functional dependencies in deeper levels of detail, there is a clear problem of representation. DCSYM joins the scene in this area and provides us with the means to further analyze the organization. DCSYM also carries the concept of communications (human and non-human), links and connections among the structural entities, thus transforming our initial static diagrams into dynamic charts of the organization, based on the initial foundations of Beer's VSM plan. But in today's complex organizations we have so many interactions that we need a more elaborate way of defining the authoritative hierarchies among members of the personnel who are responsible to carry out procedures. For that reason we adopted the idea of designing the control and meta-control (META) phenomena that are inserted in the multiplex of relationships in a DCSYM design and make their presence so important among the structural entities, for the business operation. All of these methodologies are unified under the supervising philosophy of a TSI and all the process is then designed over a process design tool as JOGET.

The purpose of building VIPROCE is to have a scientific but also practical and productive tool in order to detect and solve process problems by constructing diagrams which serve as a communication language for the participating members and process step of the problem we face. VIPROCE emerged as a multi-methodology that could bridge the gap between diagramming-structuring techniques and strategic-procedural planning. It successfully matches well-known methodologies in any business level using basically the DCSYM as a design and representation tool and a process design tool as JOGET.

1.1 VIPROCE's Steps

VIPROCE begins with a 'data collection' phase (creativity), continues with an 'analysis phase' (selection) and finishes with a 'design phase' (application). Mixing methodologies for the study of complex organizations both in the managerial and/or in the technical level, needs to deploy a uniform representation and diagramming technique as a language of communication among the different parties of the problem, in order to achieve maximum consistency. Beer's VSM (Perez, 2008) can be adopted in the meta-system and meta-control approach. After the completion of meta-control, processes are designed and even be simulated with the use of tools as JOGET. The use of such tools provides the ability to elaborate several scenarios into one process and gain the most of it. In general, an application of VIPROCE, along with the details of the corresponding methodologies that are used, consists of the following five basic steps:

Step 1 TSI
Step 2 VSM+ TSI
Step 3 PSM + VSM + TSI
Step 4 META+ PSM + VSM + TSI
Step 5 JOGET+ META+ PSM + VSM + TSI

2 Conclusions and further research

Main care is VIPROCE to remain simple to comprehend and implement. VIPROCE provides proper tools for a study of an organization. One negative aspect of VIPROCE is the fact that due to its reliance upon Beer's VSM as the initial foundation, it is somewhat constrained to organizations and enterprises. Therefore, it might not be particularly useful when analyzing other systems, such as political or social ones. Here is the point for further research where other relevant methodologies may be included in VIPROCE.

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Developing the dynamic layer within the Design and Control Systemic Methodology – DCSYM-2

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Abstract: A key challenge of the modern organization is to continually align its processes, resources and capabilities to reflect an ever-increasing turbulent environment, while reinforcing its structures and functions so that they continue to support the organization's purpose. This work will introduce a Methodological Systemic Scheme (MSS) which is derived from the semantic diagramming principles of the Design and Control Systemic Methodology (DCSYM) and the Causal Loop Diagramming techniques used in System Dynamics that can be used as an effective means through which the modern organization can apply a systems approach to its management paradigm for the purpose of embracing change while reinforcing the structural cohesion of the various organizational units of which it is comprised, which will enable them to respond successfully to the diverse conditions emerging from the various internal and environmental influences to which they are subject.

Keywords: Systems Thinking; DCSYM; DCSYM-2; Methodological Systemic Scheme (MSS); Causal Loops; Process Approach; Process Modeling.

1 Dealing with Organizational Complexity

Twenty-five hundred years ago, Heraclitus of Ephesus argued that “there is nothing permanent except change.” The resilience of this argument is certainty more compelling today in light of the dynamic complexity of an interconnected world in which stubborn problems persist despite our noblest efforts to address them. This reality is further complicated by the fact that solutions successfully employed in the past on the bases of the theoretical assumptions that were held as “universal truths” may no longer effectively address the convoluted issues faced by the modern organization, at present, or the foreseeable future. Organizations are increasingly realizing that their very survival often depends on their ability to change. In fact, in the context of today’s fluid environment, change may prove to be the key challenge for the modern organization, and its ability to successfully align internal processes and capabilities to the various influences to which it is subject, paramount in ensuring the viability of its structures and functions so that they continue to support the organization’s purpose.

Each decision a manager makes is grounded in the underlying assumptions between the present and a future state relative to achieving a goal or addressing a condition which warrants attention. Ultimately, every decision entails changing current practices to drive the organization and/or its processes to a new desired state, or changing current practices and processes to preserve the current state in response to internal or external influences which would result in inadvertent transformation if the current state remained inert. In allegory, a sailboat’s helmsman must occasionally make course corrections to reach an intended destination ***and*** change the position of the helm and sails in response to changing conditions, if the craft is to maintain a desired course. In fact, it has been argued that change and stability are parts of the same process.

While the need to frame the issues that warrant management action as part of a structured process is tenant for the modern organization’s continued existence, capturing the essence of convoluted problem situations rarely occurs as an objective event. Interpretation of the essential properties of observed phenomena involves observer participation, a reciprocal process in which both the observer and the phenomenon observed constantly form and reform one another. This interaction enhances the ambiguity of the causal relationships embodied in the perceived phenomena, further increasing the difficulty of framing the issues associated with the problem at hand, exploring the variables involved, and formulating actions to achieve a desired state. As dynamic complexity increases, the expected results of management decisions are increasingly difficult to anticipate and the organization’s capacity to maintain a competitive advantage diminished unless these decisions reflect a fact-based proactive posture, within the context of a holistic approach.

Yet most traditional management tools employed to support decision makers lack the sophistication to effectively address the dynamic complexity inherent in the modern organization’s business environment, relying on simplification rather than holistic treatment of complexity. They tend to embrace a single perspective and direct attention to the symptoms rather than the underlying structures which are responsible for the manifestation of the symptoms in the first place. Hence, problems are often treated as static events and addressed within strict functional boundaries, ignoring complex networks of time delayed feedback mechanisms that very in strength and direction, and non-linear relationships between the intervention and the resulting consequences. Thus, the impact of a well intentioned intervention on one part of the system treated in isolation may be entirely different than the (often counterintuitive) consequences that surface on other parts of the system, with entirely different short and long term results.

1.1 The DCSYM-2

This work will introduce a **Methodological Systemic Scheme** (MSS) through which the modern organization or business can apply a systems approach to its management paradigm for the purpose of maintaining the cohesion of the various organizational units of which it is comprised, without compromising the required autonomy which enables them to effectively respond to (1) the diverse conditions of the various macro and micro environmental influences to which they are subject, and (2) the emerging inter-organizational oscillatory type of responses that result from feedback mechanisms that operate to achieve internal equilibrium following intervention.

The MSS is designed to serve as the practical means through which to augment management's capacity to align the organization's tactical planning with the system's operational capabilities, by providing a clear understanding of the structural relationships between the various interrelated and interdependent elements interacting to form a coherent functional whole (system). Specifically, the MSS makes use of the semantic diagramming principles of the ***Design and Control Systemic Methodology*** (DCSYM) for the purpose of mapping out complex structures so as to depict both content and context, and the ***Causal Loop Diagramming techniques*** used in System Dynamics to reveal the manner in which the various variables in the system are interrelated, thus providing an indication of the system's behavior over time. Through the MSS a dynamic layer is added to the DCSYM – which we shall call **DCSYM-2** - which serves as a systemic management platform with which the policy-maker can bridge the gap between the present and a future state when planning, organizing, directing and controlling change initiatives. The MSS captures the structural, the behavioral and the hierarchical aspect of systems. In short, the MSS bring out the structural composition of the system and defines the dynamic relation of system's elements by showing how element X effects element Y and, in turn, how element Y effects element X, through a chain of cause and effect relationships. Through the use of the MSS a dynamic layer is added to the existing schematic representation created by the DCSYM, reflecting the causal influences among the system's elements, making it possible to ascertain the system's behavior relative to its operational capabilities.

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Dynamics of agricultural knowledge production: learning from a systems thinking perspective

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Abstract: The structure and the nature of scientific work are commonly investigated from a macro perspective. Notions such as 'Mode 2 knowledge production', 'Post-normal Science', and 'Postacademic Science', therefore, can all be typified as 'macro analyses', for focusing on general features of the scientific practice. Each of these conceptualisations captures relevant aspects of the processes through which scientific knowledge is produced, in the context of the highly developed nations. As macro analyses, however, they are liable to conceal or overlook significant specificities and internal variances within and across different knowledge domains. This study aims to explain the culture and practice of agricultural research from a systems perspective. A qualitative research approach was used, with soft systems thinking as a philosophical stance. Data was gathered through in-depth interviews with twenty-six agricultural researchers from the Brazilian Agricultural Research Corporation. Results showed that, although from a macro-perspective agricultural research might appear as a solid, cohesive knowledge domain, a meso-level analysis unveils different cultures of agricultural knowledge production, which otherwise would not have been perceived. Correlating between the macro-level and the meso-level is an important step towards achieving a better understanding of the complex phenomena of agricultural knowledge production in the context research organisations.

Keywords: Systems thinking, agricultural knowledge production, epistemic culture, macro analysis, meso analysis

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This extended abstract is available from http://emcsr.net/book-of-abstracts/

1 Introduction

Attempts to describe the way scientific knowledge is produced have flourished in the literature of the last 40 years. The conceptualisations known as 'Finalization Science' (Böhme et al., 1983), 'Strategic Research' (Irvine & Martin, 1984), 'Post-normal Science' (Funtowicz & Ravetz, 1993), 'Mode 2 Knowledge Production' (Gibbons et al., 1994) and 'Postacademic' Science (Ziman, 1996), for instance, represent different attempts to make sense and assess the wider implications of the recent developments in scholarship.

In common, these theoretical accounts were produced in the context of highly developed nations, such as the UK, USA, Germany and Australia. There is a lacuna in the literature when it comes to the recent developments of science in the context of developing countries[1]. Owing to infrastructure issues, financial, institutional and human resources' constraints, however, research systems might operate significantly differently in the developing world. Besides, more than 80 percent of the world's population live in developing countries (World Bank, 2013a), a figure that reinforces the relevance of approaching the context of developing countries in studies of Science and Technology.

Also in common, the mentioned conceptualisations focus on general features (system-wide properties) of the research practice — this being the reason why they can be interpreted as 'macro analyses' of science (Knorr-Cetina, 1981). An important critique of studies of science from a macro perspective is that they tend to assume a theoretical stance, rather than an empirical one; this being the case with accounts such as Mode 2 (Gibbons *et al.*, 1994) and Post-normal Science (Funtowicz & Ravetz, 1993). And, perhaps most importantly in the context of this study, macro analyses of science most commonly adopt a 'unitary' view of science, and thus are liable to conceal or overlook significant specificities and internal variances within and across different knowledge domains. Contrariwise, the literature shows that scientific systems and communication patterns have varied "both temporally and between different scientific sub-groups — and so accordingly have corresponding normative patterns" (Barnes and Dolby, 1970, p.8).

Since research systems operate differently across diverse social and political contexts, this study aimed to explain agricultural knowledge production from a systems perspective, at both a macro- (the whole research system) and a meso-level of reality (local practices and culture in a research organisation).

2 Methods

Soft systems thinking (Checkland, 1981) comprised the main philosophical framework of this study, guiding the inquiry into real world complexity by using systems for learning. To better learn about the processes of agricultural knowledge production, a single case study involving the Brazilian Agricultural Research Corporation (Embrapa) was undertaken. Qualitative data was gathered through in-depth interviews with twenty-six researchers (from

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1 The World Bank classifies national economies as low income, middle income (subdivided into lower middle and upper middle), or high income, based on the levels of Gross National Income Per Capita (GNI). Therefore, a country with a GNI of $1,025 or less is considered 'low income'; $1,026 to $4,035, 'lower middle income'; $4,036 to $12,475, 'upper middle income'; and $12,476 or more, 'high income' (World Bank, 2013b). Following this definition, countries with low or middle levels of GNI are classified as 'developing countries' — even though not all economies in this group experience similar rates of development.

different agricultural science sub-disciplines and varied levels of hierarchies and seniority levels), selected through systematic sampling (Walliman, 2006).

So as to comply with the systemic principle of this study, data gathering was followed by a thematic, two-level analysis. The wider agricultural research system in Brazil comprised the 'macro-level' of analysis, while the 'meso-level' (embedded in the 'macro') examined the local practices and culture of agricultural knowledge production at Embrapa[2]. Research findings are presented and discussed in the following sections.

3 Lessons learned from a macro-perspective

At a macro-level of analysis, a set of system-wide properties was identified that brings form and cohesion to the broad domain of agricultural science. Some of these properties are of an epistemological nature and indicate an imperative (and the gradual development) of a more open, collaborative system of agricultural knowledge production. These are: the 'increasing complexity of research challenges'; a 'growing focus on societal impact'; the 'transcending of disciplinary and institutional boundaries' and the 'greater engagement of societal audiences' in the research activity.

The 'increasing complexity of research problems' was identified as an impetus of change in the ways agricultural knowledge is produced in Brazil. To cope with the multifaceted problems presented by contemporary society, a more open, reflexive, and collaborative system of agricultural knowledge production is being required. This was evidenced by the fact that disciplinary, institutional, and national boundaries are becoming more and more blurred, with increased participation of societal audiences in the research process.

In contrast to this emphasis on sharing, another set of macro-properties was found to invite individualism and competitive behaviour between departments, laboratories and researchers. These properties can be described as: the 'expansion of competitive funding'; the 'intensification of research steering'; an 'increasing focus on the commercialisation of knowledge'; the 'pressure for accountability and research quality monitoring'; the 'strong focus on academic impact; and the 'high heterogeneity, in terms of physical and human resources availability' across research units of Embrapa.

From the macro-level analysis, therefore, it was discovered that collaboration, as an epistemological demand of contemporary agricultural research in Brazil, is continuously faced with competitive forces that emanate from the research funding schemes and the managerial systems of resources allocation, performance evaluation and reward. The paradoxical relationship between collaboration and competition was then identified as a 'holistic' property of the Brazilian agricultural research system, since it arises from the interaction and cumulative effect of all other macro-properties.

4 Lessons learned from a meso-perspective

While from a macro-perspective Brazilian agricultural research might appear as a cohesive knowledge domain, a meso-level analysis disunited agricultural research into three different

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[2] A micro-level of analysis would focus on the individual actions of researchers, which was not a purpose of this study, due to an understanding that "once a social system is in place, individuals become replaceable to some extent; their roles can be enacted by different persons" (Bunge, 2000, pp. 149–150).

epistemic cultures (Knorr-Cetina, 1999). These were named *in situ*, *in vitro*, and *in silico research,* in keeping with the main experimental setting where knowledge production takes place in each of these cultures.

The three epistemic cultures differ for a range of features, such as the types of outcomes produced by research, the groups of beneficiaries it seeks to serve, and the level of engagement of these groups in the research process. **Table 1** specifies the differences found between the epistemic cultures of agricultural research.

Table 1: Differences found across the epistemic cultures of agricultural research

Feature	**Epistemic cultures/experimental settings***		
	in vitro	***in situ***	***in silico***
Outcomes of research			
Processes	+	+++	++
Products	++	++	++
Scientific knowledge	+++	+	++
Beneficiaries of research			
General audiences (in special farmers and technicians)	+	+++	++
Research peers	+++	+	++
Focus of research			
Local development and support to farmers	+	+++	+
Commercialisation and profit	+++	+	+++
Research outputs			
Technical publications directed to farmers	+	+++	+
Participation in conferences	++	++	++
Scientific articles	+++	+	+++
Common partners and types of collaboration			
Farmers, participatory research	+	+++	+
Research peers, cross-institutional scientific collaboration	+++	+	+++
Focus of international collaboration			
Knowledge sharing/transfer in South-South partnerships	+	+++	+
Knowledge advancement in North-South partnerships	+++	+	+++
Audiences of scientific publications			
Local public (in Portuguese)	+	+++	+
International public (in English)	+++	+	+++

*Amount of '+' means emphasis.

By being embedded in the macro-level of analysis, the three epistemic cultures are subject to the forces that govern agricultural research as a whole in Brazil. By being widely dissimilar, however, '*in situ*' and '*in vitro*' research respond differently to the conflict of collaboration and competition, which was identified as a holistic property of Brazilian agricultural research. *In situ* research is not prioritised in the competitive environment that is unintentionally encouraged by managerial and organisational aspects of agricultural research in Brazil. This is due to the more open and collaborative character of this epistemic culture, which is focused on the production and wide dissemination of pragmatic knowledge for the benefit of local farmers and agricultural systems. For *in vitro* research — which concentrates on the production of cumulative knowledge that is mostly disseminated within the scientific community, with a view to commercialisation and profit — such an environment exacerbates the naturally more competitive epistemic culture.

Figure 1 summarises the main issues that emerged in the data analysis, which represent macro- and meso-properties of the Brazilian agricultural research system.

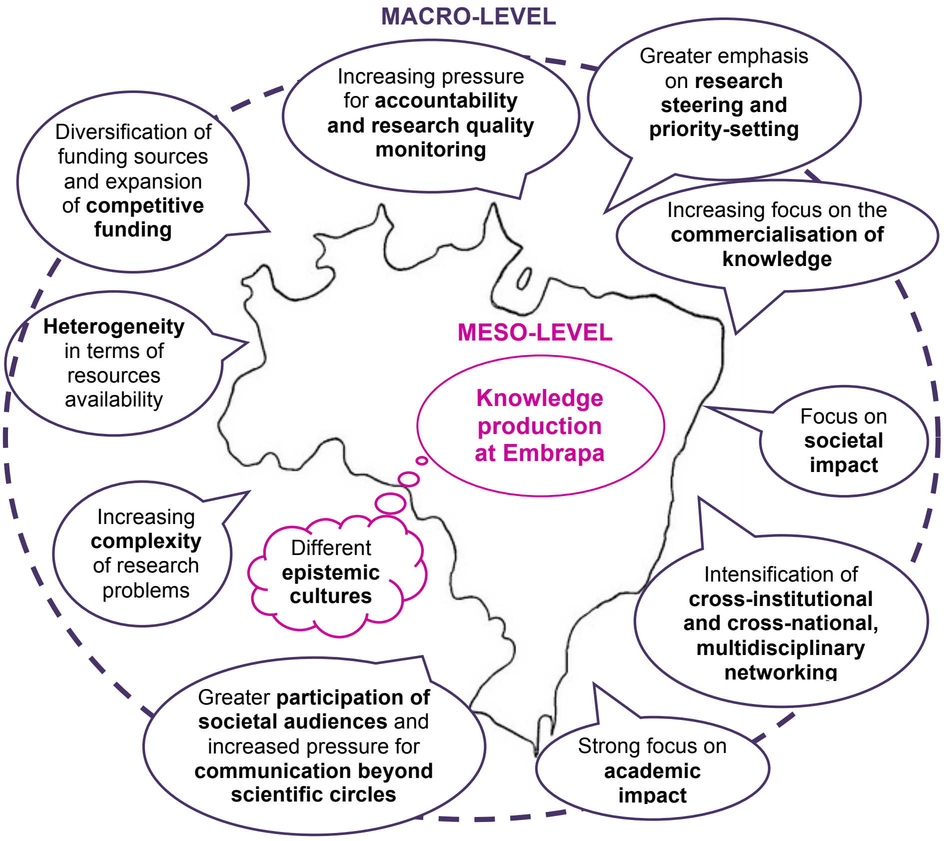

Figure 1: Macro- and meso-level observations regarding the Brazilian agricultural research system.

5 Discussion and conclusions

Having employed a systems approach to explain the dynamics of agricultural research in Brazil, this study yielded findings that aligned on two different levels of granularity — the 'macro-' and the 'meso level'. It is worth highlighting, however, that the terms 'macro', 'meso', and 'micro' are relative, forming a continuum in such a way that, what is macro from one's perspective may be micro from another's (Eulau, 1986, p.90). In other words, what is macro, what is micro and what is in-between in a social study is a choice of the researcher. In the present study, the meso level fitted between the micro-level context of the participants' individual perceptions and the macro level context of the larger system of agricultural knowledge production.

One of the sources of uniqueness of this study is that it represents an insightful approach in reconciling the understanding of the functioning of large research systems with knowledge production at local settings. Embedded within the macro level, the meso level of analysis allowed the identification of different units of organisation in agricultural research; different epistemic cultures. In other words, it unveiled the 'disunified' nature of agricultural knowledge production and variations that otherwise would not have been perceived. For instance, whilst 'greater participation of societal audiences' stood as a macro-property of the agricultural research system, the level of engagement of society in the research process was found to vary across epistemic cultures, achieving its maximum in *in situ* research.

It is concluded, therefore, that the different levels of granularity are complementary and contribute to a better understanding of the complex phenomena of knowledge production. Digging deeper into each epistemic culture of agricultural research and conducting a more thorough analysis of the interrelationships between macro- and meso-observations are promising areas for future work.

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Fundamentals and implications of systems science

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Abstract: The awareness of the 'systemic view' of parts of the world in all its diversity has created immense interest, a large variety of beliefs, views and methods of modelling. We briefly outline the strands of this variety in the following pages.

Keywords: Systems science; linguistic modeling; ordered pairs; predicate logic

1 Formulation of the Problem

The awareness of the 'systemic view' of parts of the world in all its diversity has created immense interest, a large variety of beliefs, views and methods of modelling. We briefly outline the strands of this variety as follows:

1. Descriptive approaches

Perhaps this trend started after development of control theory during WW2 with von Bertalanffy, Rapoport and Boulding in the 1950s who recognised the pervasive nature of the 'systemic view' and introduced the notion of 'general systems theory' [Klir with mathematics], followed by others like Ackoff, Vickers, Churchman and Beer in the 1970-80s. This **speculative** trend is still well supported today.

2. Methods of modelling

These include diverse variety of models of aspects of the systemic view, a few with wide recognition and application such as control theory, operational research, expert systems and artificial intelligence. Other models include: universal modelling language, viable systems model of Beer, systems dynamics and so on. These models vary in scope and rigour and their symbolic content covers specific aspects of the 'systemic view'.

3. Design flavour

Workers in this area like Warfield, Banathy and Checkland produced writings on designing human activity scenarios. Their suggestions are descriptive without in depth appreciation of 'design thinking' and a lack of well-defined symbolism.

4. Philosophical trends

The systemic view has given rise to thinking on a broader level along the lines of views of biology, management and critical theory, emancipation, chaos, complexity, cybernetics, reflexivity and so on.

This vast and diverse intellectual effort has led to the following problematic issues:

1. Fragmentation of the essentially **indivisible** 'systemic view' into topics like information systems, systems engineering, soft/hard methods and so on. The search for a general systems theory ceased after the initial enthusiasm.
2. Lack of a **fundamental theory of systems.**
3. The 'systemic view' is not rooted in branches of **existing knowledge** and is not related to aspects of the **historical background** of human intellectual endeavour.
4. Strong **educational** issues (anomaly between conventional science and engineering) still prevail with a lack of **discipline of systems**.
5. Lack of evaluation of **impact** of the 'systemic view' on society.

The objective of the proposed paper is to outline: The development of **'systems science',** which is intended to alleviate the problematic issues, Its role in **problem solving**/design and Its influence: on people's thinking by viewing parts of the world in static and dynamic **states** and on **education**.

2 Fundamental Propositions of 'Systems Science'

Construction of a view of parts of the world that may be described as 'scientific' needs one or more 'law-like statements' followed by a 'symbolism' which translates these statements into models capable of being exposed to experience. For the 'structural view':

A. A belief about the nature of the world: 'The 'systemic view' of parts of the world is **pervasive, indivisible** and **empirical',**

B. Change of existence of parts of the world: 'Any part of the world can be seen to change by 'sets of objects in informatic and/or energetic interactions operating in an algorithm [the **producers**] to create or to destroy a physical, intellectual or emotive **product** intended for the benefit or otherwise of individuals [the **consumers**]',

C. View of existence of parts of the world: 'there is an agreed number and kind of parts or theoretical **objects** each with its own qualifiers AND these parts are connected into =

X. A static **structure** [recognised by qualified relations as stative **verbs**] to represent a part of the world or a state, OR

Y. A dynamic **structure** [recognised by qualified interactions as dynamic **verbs**] to represent activity.

The symbolism is based on 'processed natural language' derived from a 'story of scenario', which is the most general means of representation and communication or a model. Meaning preserving linguistic transformations convert a story into 'basic constituents' of one - and two – place sentences of which complex static or dynamic structures can be constructed in terms of 'ordered pairs' or 'predicate logic statements'.

3 Conclusions

The linguistic, diagrammatic structures of **linguistic modelling** can carry uncertainty, mathematics and are highly computable and teachable. They can be part of **design, problem solving** to represent **prototype** models to transform a problematic into a resolution state. The method is highly relevant in social problems and in education.

An example: The narrative of a scenario: 'There is a farm with land for grazing but in the winter for the cows to be able to give milk, they must eat hay which is delivered to them by the farmer who uses a tractor, from the store to the shed twice a day. Machines milk the cows every morning. Having accomplished these jobs, the farmer is content'. The narrative is represented in Figure 1 demonstrating Proposition B.

The semantic diagram and linguistic network in Figures 1 and 2 show the acquired properties of the **product** as ordered pairs**.** The number of its variations is for 'n = 5', is (20 x 19 x 18 x 17)/(1 x 2 x 3 x 4) = 4845 which are all candidates for a **product**.

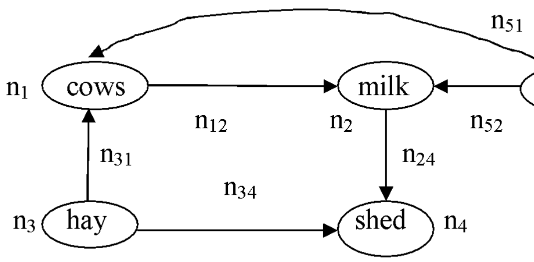

Figure 2: Linguistic network of 'hay/cows
(to be considered after Figure 1)

Figure 1: Linguistic network of hay/cows

Now that the product is available we can ask questions pertinent to particular domains of conventional science. Here we are concerned with **business science** (finance, accounting, law, marketing and so on) with a story as a continuation of the narrative of the scenario: 'The herd of cattle consists of 56 cows each eating 15 kg of hay a day during winter time assuming there is no grass and gives 18 litres of milk a day. The price of hay is £250 a tonne. The question for the farmer is --- if the winter lasts 90 days what is the minimum selling price of milk to break even ???

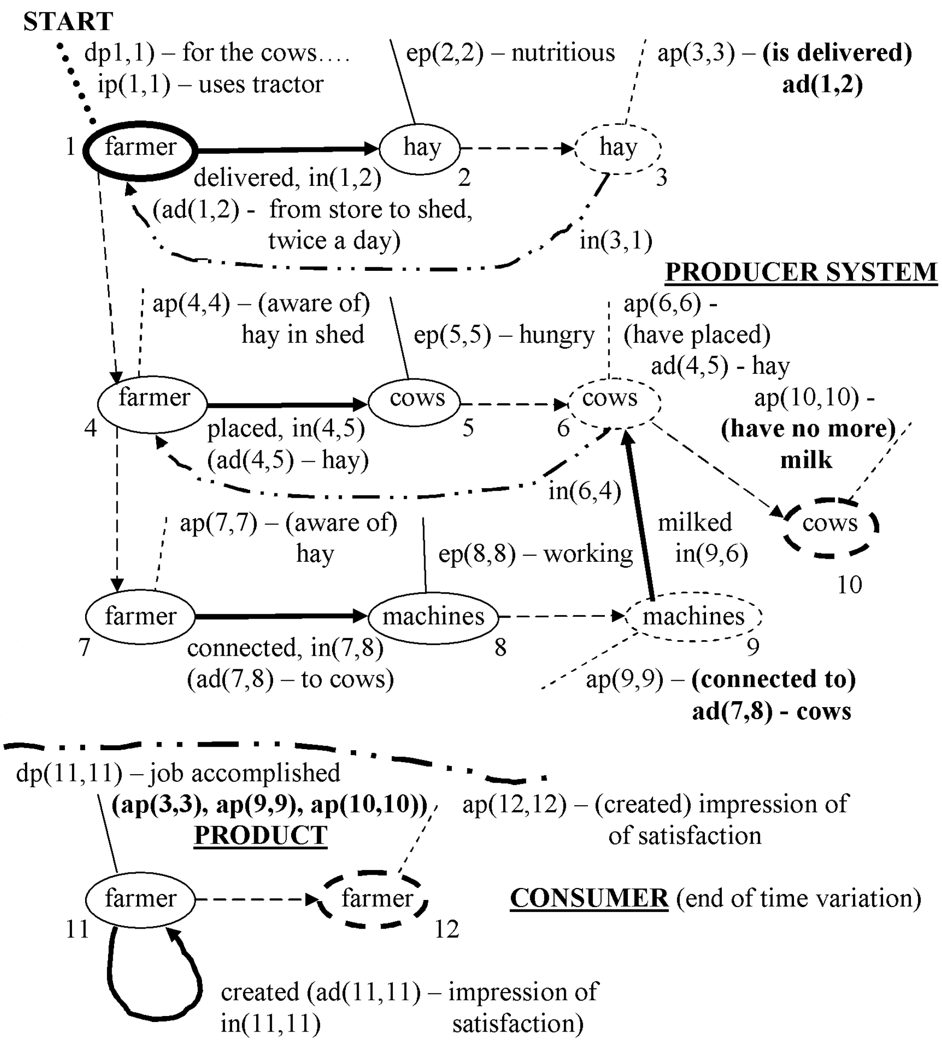

Figure 2: Semantic diagram of the farmer, hay, milk scenario

Mathematical model: Total cost of hay is 56 x 0.015 x 250 x 90 = £18900 from which the minimum selling price of milk 18900 = 56 x 18 x 90 x price which is about £0.2 per litre.

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Janos Korn graduated in mechanical engineering at Queen Mary College, University of London, in 1960. He obtained an M Phil and Ph D degrees from the same institution. He was a member of the Institutions of Mechanical and Electrical Engineering, published 4 books and 145 papers. He was a lecturer at Middlesex University until retirement.

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Professional systemics applied to the development of social skills in children with autism spectrum disorder: a case study

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Abstract: Autism is a problem of increasing global concern. The prevalence rates of children on the autism spectrum have increased 10 to 17 percent annually in recent years with no established reason for the increase. A recent innovation in autism treatment is robot therapy, considered as an adjunct to traditional behavioral therapy. However, robot therapy involves interaction among a number of individuals with different mindsets, constructs, language and procedures, including clinicians, psychologists, roboticists, interactive behavior designers, educators, the autistic child, and family members. In this paper we describe a case study of robot therapy for an autistic child. We look at the . individuals and their interactions as a system and apply systemic concepts to the approach. Our goal is to outline a practical, effective methodology for a professional service that would benefit ASD children and their families.

Keywords: Autism, Autism Spectrum Disorder, Humanoid Robot, Socially Assistive Robot, Professional Systemics, Systemic Thinking

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1 Introduction to Robot Therapy for ASD

In this paper we discuss a problem of increasing global concern, viz. the dramatic increase of children with Autism Spectrum Disorder (ASD). Autism statistics from the US Center for Disease Control and Prevention (CDC) identify 1 in 88 American children as on the autism spectrum, a ten-fold increase in prevalence in 40 years. ASD affects over two million individuals in the US and tens of millions worldwide. Government autism statistics suggest that prevalence rates have increased 10 to 17 percent annually in recent years. There is no established explanation for this continuing increase, although improved diagnosis and environmental influences are two reasons often considered (What is Autism?, 2013).

The criteria for identifying children with ASD are communication deficits, social skill deficits, and repetitive patterns of behavior, where symptoms are present usually before the child is 3 years old. These children lack social skills that we take for granted, e.g. playing with others, eye contact, ordinary conversation, and other common social behaviors.

The autism spectrum is classified into three levels (DSM-5, 2013):

- Level 1 Requiring Support - Without supports in place, deficits in social communication cause noticeable impairments. Difficulty initiating social interactions, and clear examples of atypical or unsuccessful response to social overtures of others.
- Level 2 Requiring Substantial Support - Marked deficits in verbal and nonverbal social communication skills; social impairments apparent even with supports in place; limited initiation of social interactions; and abnormal responses to social overtures from others.
- Level 3 Requiring Very Substantial Support - Severe deficits in verbal and nonverbal social communication skills cause severe impairments in functioning, very limited initiation of social interactions, and minimal response to social overtures from others.

Treatments for ASD children include behavioral therapy and medicine. A recent innovation in ASD treatment is robot therapy with a Socially Assistive Robot (SAR) (Giullian et al, 2010), (Kim et al, 2012), (Scassellati et al, 2012), (Kim et al, 2013). Robot therapy is considered adjunct therapy to traditional behavioral therapy. ASD children are interested in electronic devices and are drawn to humanoid robots. The robot is less threatening and does not flood the child with facial expressions, gestures, and perceived disappointments. Thus, there is an opportunity to work on social skills with non-threatening humanoid robots and attempt to transfer those skills to humans in real settings. Robots can aid autistic children in developing social skills by capturing and maintaining attention, evoking joint attention, eliciting imitation, and mediating turn-taking.

Importantly, (Scassellati et al, 2012) observes the following: "Despite productive collaborations between several robotics and clinical groups, robotics research and clinical psychology are significantly different fields, each with its own research methods and publication standards… By the nature of the research, developing and evaluating SAR systems for autism therapy involves researchers who specialize in computational science, mechanical and electrical engineering, robot control, human-robot interaction, social psychology, and clinical research. Few research groups have total coverage of these disparate fields, so groups tend to focus on their strengths, whether they be in robot design, interaction design, or evaluation. Unfortunately, without clinical psychiatrists and psychologists, most research groups lack long- term, continuous access to protected groups such as children with autism, making it difficult to measure the benefit of design decisions. Facilitating collaborations between clinicians and roboticists is probably the only way to enable this kind of in-depth interaction study."

We see this observation as a good reason and invitation to apply systemic thinking to autism therapy with robots. The problem calls for reciprocal understanding across different disciplinary domains as well as different schools of systemic thinking. We see the system as an organization consisting of the following interrelated entities: the ASD child, parents, siblings, educator, therapist, roboticist, behavior designer, and robot operator. The system is a soft system involving stakeholders of different mindsets and also an evolutionary system whose structure and interrelations change over multiple sessions with the child [Checkland and Poulter, 2007]. We illustrate the system and the positive impacts of systemic thinking by extrapolating from a case study. The sessions with the child were performed by this author, colleagues, and the child's family in two session in February 2014.

2 A case study

Edgar is a 6-year old Level 1 ASD child. Edgar's siblings are Lola (5 years) and Dennis (8 years). Melissa is Edgar's mother. Dr. Nancy Charron is Professor of Special Education (SPED) at Southern New Hampshire University (SNHU) and Kristen is Dr. Charron's student. Dr. Peter Frost is an experimental psychologist at SNHU. Dr. Lundy Lewis is Professor of Computer Information Technology at SNHU and the roboticist. The robot is the NAO humanoid robot developed by Aldebaran Robotics in France (NAO, 2014).

Melissa wishes her son Edgar to learn how to order a doughnut from a menu at a real store. With this goal in mind, the organization collaborated to produce behaviors for a 1st Session with Edgar and, based on the results of the 1st session, collaborated to produce behaviors for Session 2. The sequence of behaviors and results are shown in Table 1.

Table 1: Synopsis of Two Sessions

	Sequence of Behaviors	**Results**
Session 1 **2/16/14**	Introductory behavior (Hello Edgar. How are you? Good to meet you…)	Edgar is immediately drawn to the robot and is happy.
	Do what I do behaviors, e.g. raising hands, waving, sitting, wiping forehead, and others, with everybody in the room imitating the robot	Edgar withdraws, going to a corner to play a video game. Subsequently, everybody is asked to leave the room except Edgar's mother, his siblings, and the robot operator.
	(unplanned) The robotic version of the music game Simon was introduced by the robot operator	Edgar's siblings begin playing the game, Edgar is drawn to it and begins playing the game as well.
	The ordering doughnut behavior	Edgar imitates the behavior "Can I please have a chocolate glazed doughnut" several times albeit softly and without confidence.
Session 2 **2/22/14**	Introductory behavior, reinforced with encouragement to speak loudly and clearly and make eye contact	Edgar ia attentive and eager. Only Edgar's father, Kristen, and the robot operator are in the room.
	The music game, this time planned	Edgar has a blast. He speaks loudly, and begins the asking for a doughnut routine unprovoked.
	The ordering doughnut behavior, modified to encourage speaking loudly and clearly, making eye contact, and saying Thank You.	Edgar repeats the phrase "Can I please have a chocolate glazed doughnut" several times loudly and clearly, and practices Thank You.

After both sessions, Edgar was taken to a doughnut store to transfer the ordering skill to a real setting. In both cases, Edgar ordered the doughnut successfully, as was hoped. After the 2nd session, Edgar ordered the doughnut loudly and with confidence, making eye contact, and saying Thank You. These results are encouraging, but they are anecdotal, i.e. a one-shot experiment lacking scientific, quantitative backing. Plans are underway to set up a more scientific experiment under the guidance of the experimental psychologist with a classroom of a dozen ASD children rather than one child. The analysis of the current experiment via systemic thinking will instruct the later rounds of experiments.

2 Preliminary analysis and outlook

We consider the system as iterating over preparation, execution, and post-analysis. The post-analysis informs subsequent preparation for the next iteration. Table 2 shows the total system and the subset of participants in yellow for Session 1 preparation. The participants for Session 2 execution were Edgar, Father, SPED student, and robot operator.

Table 2: Participants in Session 1 preparation in yellow

Edgar	Mother	Father	Sibling 1	Sibling 2	Humanoid Robot
Experimental Psychologist	Behavior Designer	Behavior Implementer	SPED Professor	SPED Student	Robert Operator

We focus on understanding how the elements in the system affect one another and how the interactions of the elements produce emergent behaviors. Although a complete analysis cannot be given here, initial key observations/ and questions are below.

1. What are the real and desired emergent behaviors of the system during each evolutionary phase? For example, due to weather and illness, the degree of communication during Session 1 preparation was less than desired. This suggests that an additional system element is "environment" with interactions and properties thereof.
2. Edgar withdrew during the Do What I Do behaviors of Session 1. The mother indicated that too many participants were involved, after which all participants except mother, robot operator, and siblings left. The robot operator introduced the music game and the siblings began playing it. Edgar then joined in. These interactions informed Session 2 preparation. Should "session plan" be part of the system or an emergent behavior?
3. During the night after Session 1, Edgar cried continuously. It was discovered the next day that Edgar had strep throat. Mother suggested that his health probably affected his interest during Session 1 negatively. This point suggests further that health and other properties of system elements should be considered in interactions.
4. A second university student not involved in the system, who is Level 1 ASD but highly mature, functional, and intelligent, suggested he become part of the system to provide insight into preparation and analysis. What would be the expected outcomes of the introduction of this element and its interactions with other elements?

In conclusion, the results are anecdotal and require more formal experimentation to understand the merits of robot therapy for ASD children. Regardless, the approach benefits from systemic thinking. More study and work is needed in this area, e.g. constructive critique (Metcalfe, 2007), recognition of learning obstacles (Reyes, 2008), and abstraction, common language, and attitude (Gershenson et al, 2013). Our goal is to outline a practical, effective methodology for a professional service that would benefit ASD children and their families.

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Dr. Lundy Lewis is the Christos and Mary Papoutsy Distinguished Chair in Ethics and Social Responsibility and Professor of Computer Information Technology at Southern New Hampshire University in the USA. His current research investigates the use of technology to address complex social issues such as Autism Spectrum Disorders, Post-Traumatic Stress, and elderly care. His 1986 dissertation was one of the first efforts to understand how intelligent computers might have a sense of ethics in order to make decisions about doing the right thing. His lifelong scholarly activity has revolved around the application of Artificial Intelligence methods to practical business problems and the building of systems, e.g. using AI in business intelligence, situational reasoning, enterprise management, video games, and robots. He holds thirty-five US patents involving technology and has been a Principal Investigator on several multi-year projects for the US Department of Defense and the Australian Research Council. He is the author of several books on enterprise management: Managing Computer Networks: A Case-Based Reasoning Approach (Artech House 1995), Service Level Management for Enterprise Networks (Artech House, 1999), and Managing Business and Service Networks (Kluwer/Plenum Press, 2001). He has published extensively in journals and conference proceedings. He is co-founder and Chief Technology officer of three technology companies.

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Personal data protection in the electronic communications sector

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Keywords: Personal Data, Sensitive Data, Data Protection, Authorities

No abstract submitted, but reference material for the presentation is included in the appendix of this document.

Appendix Information

1 Data Protection

1) Hellenic Constitution:

a) Article 9: Privacy and family life of each one is inviolable.

b) Article 19 par.1: The confidentiality of the communications is absolutely inviolable with the exception of national security reasons and the criminal investigation, detection and prosecution of serious crimes, where the Judicial Authority is entitled to order the lawful interception of content and access to communications data. The Protection of confidentiality of the communications is also a matter of an Independent Authority (A.D.A.E.).

c) Article 9A: All persons have to be protected from the collection, processing and use, especially by electronic means, of their personal data.

2) Hellenic legal framework:

a) Law Nr. 3471/2006: has implemented Directive 2002/58/EC and modified Law Nr. 2472/1997 (implementation of Directive 95/46/EC).

b) Law Nr. 3674/2008 under the title “Ensuring the security of privacy and confidentiality in telephony services sector”: refers to security of the Provider’s services and their obligations.

c) Law Nr. 3783/2009: refers to the traceability of mobile phone users and ban of anonymity prepaid SIM cards.

d) Law Nr. 3917/2011: has implemented Directive 2006/24/EC (Data Retention Directive).

2 Personal Data

1) Definition

"Personal data" are considered to be any information relating to the data subject. Personal data are not considered to be the consolidated data of a statistical nature whence data subjects may no longer be identified (Article 2, Law Nr. 2472/1997).

2) Processing of Personal Data

Personal data, in order to be lawfully processed, must be processed as the article 4 of the Law Nr. 2472/1997 imposes.

3) Transboundary flow of personal data

The transfer of personal data is permitted (Article 9, Law Nr. 2472/1997):

a) for member-states of the European Union,

b) for a non-member of the European Union following a permit granted by the Authority if it deems that the country in question guarantees an adequate level of protection. A permit by the Authority is not required if the European Commission has decided, on the basis of the process of article 31, paragraph 2 of Directive 95/46/EC, that the country in question guarantees an adequate level of protection, in the sense of article 25 of the aforementioned Directive.

The transfer of personal data to a state non member of the European Union which does not ensure an adequate level of protection is exceptionally allowed only following a permit granted by the Authority, provided that one or more of the conditions mentioned ιν the Law Nr. 2472/1997 occur.

3 Sensitive Data

1) Definition

"Sensitive data" are considered to be the data referring to racial or ethnic origin, political opinions, religious or philosophical beliefs, trade-union membership, health, social welfare and sexual life, criminal charges or convictions as well as membership to societies dealing with the aforementioned areas (Article 2, Law Nr. 2472/1997).

2) Processing of sensitive data

Mainly, the collection and processing of sensitive data is prohibited. Exceptionally, the collection and processing of sensitive data, as well as the establishment and operation of the relevant file, will be permitted by the Authority, when one or more of the conditions mentioned in the Law Nr. 2472/1997 occur.

4 Communications and Internet Service Providers

1) Definitions

Directive 2002/58/EC and Directive 2002/21/EC: Every company or legal person or entity which falls into the definition of “provider of publicly available electronic communications service” are obligated to give access to lawful interception of the content and access to communications data after an order.

2) Obligations concerning data security

Communications and Internet Service Providers are obligated to follow mainly the obligations, which are mentioned to Law Nr. 3674/2008 and Law Nr. 3917/2011.

5 National Administrative Independent Authorities

1) Hellenic Personal Data Protection Authority

This Authority has the task to supervise the implementation of the Law Nr. 2472/1997 and all other regulations pertaining to the protection of individuals from the processing of personal data as well as to the exercise of the duties assigned to it each time.

2) Hellenic Authority for Communication Security and Privacy (A.D.A.E.)

This Authority is charged with tasks concerning communications confidentiality and data security.

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Energiaproject case study: how far can be pushed innovation in the real market?

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Abstract: Energiaproject is a program that the scientific research started in 2009 but the idea's birth created a decade ago while smaller inventions were produced and the market had accepted them and a target group was developed by the time which was happy with these products. At this time under this program many projects are being running and all of them are energy innovation systems.

Keywords: energiaproject, energy, frequency, vibration, tesla, hydrogen, water, h20, fuel, gas, petrol, benzin, diesel, DCSYM, systemic approach.

Acknowledgement: Under this scientific program many people are working and cooperating to produce results. It is a mix of real life marketing and work along with inventions and experiments which the main target is to produce science with the most effective way through innovations that are not widely used in real world. Products must make people happy and be best seller to return expenses for going on this progress.

The scope of energiaproject is to observe, check over, study, analyze, develop, test and experiment in innovation technics in the wide field of energy matters. We do not need to discover the wheel, although sometimes it happens through this journey, but most of the times we have to use efficiently what science already know. It is amazing that best inventions are those that are here in front of our eyes but never see them.

Looking around many promotions and commercials about fuel savings while I was doing my CSAP training initiated many triggers and many ideas in my mind. My initial question was if it possible to save fuel in Internal combustion engines (ICE's) and burners. If that was possible why not large companies do not advertise that and only very small and unknown enterprises were selling those? These were some of the first thoughts before get started in a systematic way to study and shape this project.

As always in research, you do not know what you will find during this quest, and at the beginning you do not even know what you are looking for. Eventually, when this process starts, every day you try to set everything in an order in a scientific way. You examine everything you hear or read or listen theoretically at first and practically in action later to investigate and find out the results from where you have to decide if you are in the correct way or not. The magic in this unknown path is that many times it happens that you think you know to discover at a later time that things are not always the way you initial thought.

1 Systemic approach

First of all you have to realize what are you really looking for, the object of the research and what are the connections with the surroundings. That means in other words you have to find all stakeholders that can affect your project. This is the most important part of the initial setup. This is what it will help to either successfully go far with the project or have to think the sequences of a failure. In our case, energy is a very delicate subject. Wars have been started many times for energy and huge interests are staked behind them. To find the viable approach and an entry to this game can be vital for the whole project. To study the strategy first of all a tracing of as many as possible of the stakeholders is required.

1.1 DCSYM

DCSYM is a systemic methodology that can visually describe the whole system to be studied. Any time can be added any new information to firm up the whole picture and help us better understand our objective. In our case, after a 5 year research a more accurate picture has been created and a SWOT analysis is appearing as more data are coming in. DCSYM can help us understand how all these are connected together and give us a semantic tool to take the right decisions. So we can realize that bellow are the most important stakeholders that must consider very serious of how we drive our project:

- Large petroleum companies
- Governments
- Other companies that sell products that will be affected of our results
- Sciences that involved

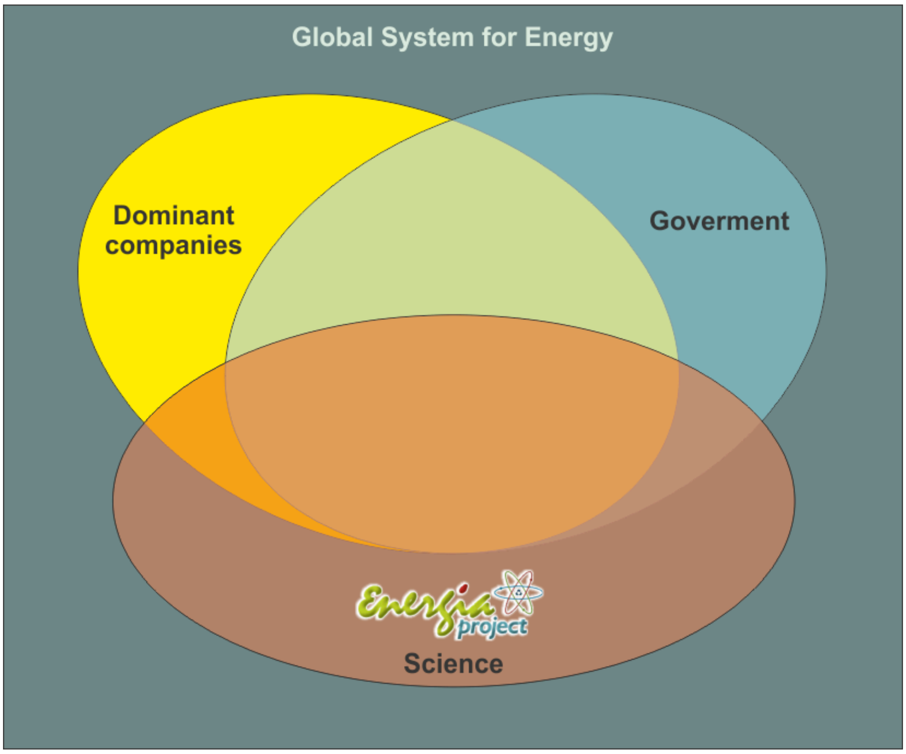

Figure 1: DCSYM representation of the study

1.2 VSM of Beer

DCSYM can describe internal factors as well as external factors too. Failure of a project can be made from inside too. So a **Viable System Model** (**VSM**) must be exhaustively setup and studied to give us the direction of how we are going to successfully deal our project.

The Viable Systems Model (VSM), developed by Stafford Beer, is an organizational representation of the elements and interactions considered essential for any system to be viable or autonomous. A viable system being one that is organized and operates in a manner such as to survive in its changing environment.

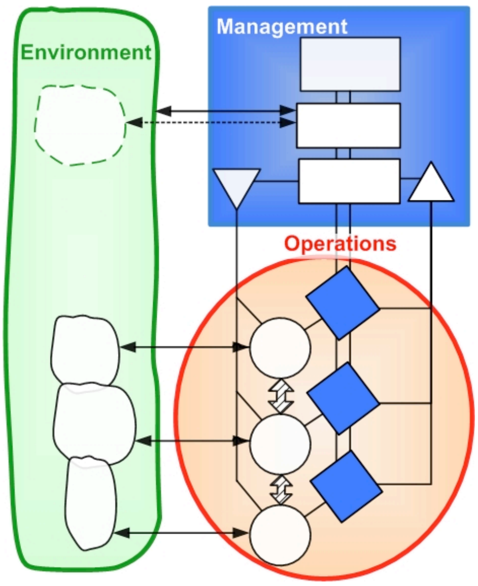

Figure 2: VSM of BEER representation

1.3 Simulation

Beyond the cooperation of many other scientist that their field is involved in our project, special tools are needed to evaluate and simulate situations and results.

Simulation can only be done with either two ways, using known theory to build a system simulation for a known behavior or creating experiments for new behaviors and recording the results, which have to be analyzed to extract the logic to use for the simulation process. This procedure can be endless, since that many parameters appears all the time and have to be measured to realize the stress and dynamic of their influence.

Table 1: Logical sequence in R&D

Trigger	Development	Experiment	Result
hypothesis	Use theory and previous data to form a new model	Test the model and discover new parameterst to involve	Final result with quantitative qualitative data
Result that do not fit existing theory	Try to figure out the cause of the event	Try to duplicate uses all available info & data	If not resolved will be recorded as “waiting” until much info will be collected to be solved.

Simulation can be done in systemic level or lab level. The first will either evaluate a hypothesis approach or consummate an existing model. Systemic simulation can be done with appropriate software as **Vensim** and **Anylogic**. The second will need to find the “numbering” meaning the quantitative approach to verify the best model.

This is a very simple view of course because sometimes to find the way out of a strange phenomenon will be result of unexpected “accidental” or “unlogical” testing.

2 Risk Analysis

Enery is a field that fired global wars, financials collisions and in that perspective is an area that has to be carefully be projectised.

2.1 SWOT analysis

SWOT analysis (alternatively SWOT Matrix) is a structured planning method used to evaluate the strengths, weaknesses, opportunities, and threats involved in a project or in a business venture.

It involves specifying the objective of the project and identifying the internal and external factors that are favorable and unfavorable to achieving our objective.

Thus setting the objective should be done after the SWOT analysis has been performed. This would allow achievable goals or objectives to be set for our project:

- **S**trengths: characteristics of the project that give it an advantage over others.
- **W**eaknesses: characteristics that place the project at a disadvantage relative to others
- **O**pportunities: elements that the project could exploit to its advantage
- **T**hreats: elements in the environment that could cause trouble for the project

Identification of SWOTs is important because they can inform us later steps in planning to achieve the objective.

First, help us to consider whether the objective is attainable, given the SWOTs. If the objective is not attainable a different objective must be selected and the process repeated.

We need to ask and answer questions that generate meaningful information for each category (strengths, weaknesses, opportunities, and threats) to make the analysis useful and find our competitive advantage.

2.1.1 Creativity methods

reativity techniques are methods that encourage creative actions, whether in the arts or sciences. They focus on a variety of aspects of creativity, including techniques for idea generation and divergent thinking, methods of re-framing problems, changes in the affective environment and so on. They can be used as part of problem solving.

Some techniques require groups of two or more people while other techniques can be accomplished alone. These methods include word games, written exercises and different types of improvisation, or algorithms for approaching problems.

> *"<u>Best ideas come with pizza and beer:</u> **Brainstorming** is a group or individual creativity techniques by which efforts are made to find a conclusion for a specific problem by gathering a list of ideas spontaneously contributed by its member(s)." (The term was popularized by Alex Faickney Osborn in the 1953 book Applied Imagination)*

2.1.2 Decisional methods

Decision analysis (DA) is the discipline comprising the philosophy, theory, methodology, and professional practice necessary to address important decisions in a formal manner. Decision analysis includes many procedures, methods, and tools for identifying, clearly representing, and formally assessing important aspects of a decision, for prescribing a recommended course of action by applying the maximum expected utility action axiom to a well-formed representation of the decision, and for translating the formal representation of a decision and its corresponding recommendation into insight for us as decision maker and the stakeholders involved.

2.1.3 Diagnosis

Diagnosis is the identification of the nature and cause of a certain phenomenon. Diagnosis is used in many different disciplines with variations in the use of logics, analytics, and experience to determine "cause and effect". In our case as engineering and research science, it is typically used to determine the causes of symptoms, new inventions, and solutions

2.1.4 Management by projects

It ensures the effective solving in a shorter time of different complex problems, which are strategic and strongly innovative projects. It is used because change and performance orientation are major coordinates of our preoccupations. It leads to an accelerated dynamics from process and structure organizing point of view, with favorable consequences regarding the human involvement in meeting objectives.

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After a career in Hellenic Air Force as a Military Telecommunication Mechanic with experience in Managements and Engineering locally and internationally in NATO and USA Air Force Bases, entered University of Patras and successfully attained Bachelor of Business Management Administration while at the same time successfully attained Postgraduate CSAP in University of Piraeus. Since 2010 is tactical member of Hellenic Society for Systemic Studies (HSSS) and currently Project Manager of energiaproject R&D.

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III C 1
Unity through diversity: learning in a complex world

Chairs

José María Díaz Nafría, Universidad de León
Rainer E. Zimmermann, University of Applied Science Munich

The problems accumulated by our contemporary societies has broken the traditional cast of the sciences. From the cabinets of the specialized professional and scientific disciplines we find few solutions to the challenges our society is facing within the finitude of our earth ecosystem; but even within very restrictive contexts the linear paradigm of modernity, as an analytical tool to tackle problems, is challenged by the very fact that even smalls parts of reality are much more complex than what linear models sketch. After a century of fundamental findings showing us that non-linearity, and complexity are spread all over reality, why is our academic and education system still casted by the positivist taxonomy of knowledge? Shouldn't we bridge the sciences, create the conditions to learn and investigate the different aspects of reality, the swarm of connections constituting it? By doing it, would not we create the conditions to educate for reflecting the world, acting upon it, leveraging the transformations of the world towards a horizon of more decent life?

List of Contributors

Marcelo Leon Castro and Eva Alavi: The interdisciplinary approach in the social and economic configuration of the Ecuadorian model
Valentin Fiala, Rebecca Paxton, Jonas Oßwald: The missing link: can Zombies as a 'meataphor' bridge the gap between Agent Based Modelling and qualitative social science?
Asimina Koukou: The emergence of an EPS in times of crisis
MingFen Li: Wicked social systems reorganized by benevolent social behaviors
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The interdisciplinary approach in the social and economic configuration of the Ecuadorian model

Marcelo León Castro

Eva Alavi

Ecuador has approximately 15.492.264 inhabitants, of which 7 million are registered in the *Población Económicamente Activa PEA* (economically active population record) in accordance with provided information by the INEC, *Instituto Nacional de Estadísticas y Censos (national institute of statistics and census)*. Santa Elena, as one of the 24 ecuadorian provinces, with a population of 308,693 inhabitants, is distributed in three cantons, Salinas, La Libertad and Santa Elena and shall be analyzed in this paper as the main region of investigation.

In the local area doesn't exist consolidated and reliable information about the relation between the productivity and all socioeconomic development. Encouraged through the advancement of the "Economía Popular y Solidaria", there exist initiatives which aren't nationalized within the communities of the province of Santa Elena. This becomes apparent facing the low individual and communal knowledge concerning the existing problematic.
The entirety of the given factors limits the conception of any respond to the basic needs, and the solutions which should be directed to turn on the citizen of the investigated communities to originate their own full human development, with an active women's participation.

Since 2011 Ecuador has incorporated the new law of *common and solidarity economy*, in which, through the institution of the EPS, it proposes and executes public politics, coordinates, organizes and applies planes, programs and projects which contribute to the construction of the system *of social and solidarity-based economy* established on the concept of *Sumak Kawsay (Good Living).*

The main characteristics and proposals relate to:
- strengthening of organizational consolidation
- Productive development and processing
- Interchange and markets
- Administration and management of expertise and interdisciplinary skills

The concept of *solidarity economy* is based on a new efficient capability, democratic administration as well as the equality of rights and responsibilities. A certain arrangement of property concerning distribution of profits finally should change the common form of redistribution, which is meant to be a central objective.

1 The underlied principles of the model

The under lied principles are officially registered in the fundamental law of *common and solidarity-based economy* and in the sector of popular and solidary finance. They correspond to these ideas of the common and solidarity economy which present a clear difference to the private economy.

While realizing their business activities organizations and persons protected by this law adhere to these principles, which can be named as such:

a) The pursuit of the "Good Living" and a self-supporting community
b) Taking priority of work over the capital as well as collective interests previous to individual interests
c) Fair trade and an ethical and responsible consume

d) Gender equality
e) The respect of cultural identity
f) Local self-administration
g) The social and environmental responsibility, solidarity and financial accounting
h) Equable and solidary distribution of overplus

2 The “Good Living” or Sumak Kawsay

What is the so called “Good Life”?
In recent years in many countries there have been generated proposals of profound change-strategies which involve ways leading to a principally social transformation. The demonstrations and uprisings especially from the indigenous world in Ecuador and Bolivia emerge as the genesis of cultural and social historical processes over a long time that form the basis of Good Living, ‘Sumak Kawsay’ (Kichwa language) or sum qamaña (Aymara). In Andean countries such revolutionary proposals in their discussions gained momentum constituents and are reflected in their constitutions.
This conception of Good Living uncovers errors and limitations of the various theories of the so-called development. It criticizes the common notion of development itself which has become a norm and unreality that governs the life of a huge part of humanity. On the contrary it is impossible to achieve the development longed for, while those who pretend to be seeking progress increasingly show signs of their actually bad development. Therefore, and especially to understand the whole concept of ‘Good Life’, which cannot be merely associated with „western Welfare ", there has to be recovered a holistic view and perspective on indigenous peoples and nationalities.
Nowadays more than ever, facing the international financial meltdown, which is just one facet of civilization crisis looming over humanity, it is essential to build other forms of life, which are not regulated by the accumulation of capital. The Good Life serves in this, especially for his transformative, political and motivating value.
Since the acceptance of an economy that relies on solidarity, there have to be found other ways to build another type of production, exchange, cooperation and capital accumulation and distribution of income and wealth. What shall be looked for, is to incorporate criteria of sufficiency rather than sustaining the logic of efficiency which is defined as material accumulation which increasingly accelerates towards a democracy trying to catch up.
Therefore, the ultimate goal is to build a community based on an economic system guided by reciprocity. To achieve this dual objective of solidarity and sustainability, it will be necessary to go along the paths which allow leaving behind the logic of social and environmental devastation which dominants today. The biggest challenge within the transitions is to be found in overcoming those cultural patterns assumed by most of the population permanently pointing to a greater accumulation of material goods.
So the Good Life serves as a platform to discuss and implement responses to the devastating effects of climate change at the global level and the growing social marginalization as well as violence. In this sense the construction of Good Living as part of deeply democratic processes, can be useful in finding even global responses to the challenges that face humanity (Acosta 2013).

The Law of common and solidarity economy emphasizes the following aspects:
Configuration of the cooperative sector (Extracted from Article No. 21)

“It is the unity of cooperatives which understand themselves as societies made of persons who got voluntarily together in order to satisfy their economic, social and cultural needs shared by all of them. This goes along with the support of a common-property corporation of democratic administration, having legal capacity in private right and social interest.
These cooperatives, within their activities and relations, link to the principles established in the fundamental law of social and solidarity economy and in the common and solidary financial sector to the universal values and principles of cooperativeness and to the practices of a cooperating government.”

Configuration of the associative sector (Extracted from Article 18)
"It is the unity of associations constituted by natural persons performing economically productive, similar or complementary activities with the objective of producing, commercializing and consuming goods and legal and socially necessary services, self-supplying with primary product, costs, instruments, technology, equipment and other commodities, or commercializing the own production in a solidary and self-administrated form which is bound to the legal demand."

Configuration of the communal sector (Extracted from Article 15)
"It is the unity of organizations which are linked by territorial reasons, family, ethnical, cultural, gender identities, urban or rural; or, by commune, communities, people and nationalities, which through their united work, share as an objective the production, commercialization, distribution and the consume of goods and legal and socially necessary in a solidary and self-administrated form which is bound to the legal demand."

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The missing link: can zombies as a MEATaphor bridge the gap between agent based modelling and qualitative social science?

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Abstract: This paper explores the use of zombies as a vector to bridge the methodological and epistemological gap between qualitative social science (QSS) and Agent Based Modelling (ABM) for describing system behaviour. Zombies were chosen because they have simple characteristics, which make them easy to understand from a QSS perspective, and their behaviour easy to explain based upon simple ABM models. We hypothesized that this simplicity would ease the transfer of QSS based data to ABM models. A workshop was carried out with students of a Masters course on ABM, in which role-play was used to give participants a greater understanding of their zombie agents. Participants from the workshop subsequently competed with other classmates in modelling "human vs. zombie" models. The models, along with workshop observations and interviews with the participants were used to assess increased understanding of the zombie agent among the participants, and how this knowledge was transferred to their ABM models. Initial results showed that the workshop provided a greater understanding of the zombie agent. However, participants were not able to transfer this new QSS based data to their ABM models. This disproved our starting hypothesis that a simple, understandable agent could act as a bridge between QSS and ABM. The workshop and role-play approach was, however, successful in highlighting the divide between QSS and ABM for the participants, and encouraged further research into bridging this gap.

Keywords: Agent Based Modelling; Qualitative Social Science; Role-Plays; Zombies

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1 Introduction

This paper considers the use of zombies as an agent for bridging the gap between qualitative social science (QSS) and Agent Based Modelling (ABM) of social behaviour. ABM applies simple rules of behaviour to build models that explain large-scale (social) phenomena (Macy & Miller, 2002). Such simple models of human behaviour are not used in qualitative social science. QSS tries to reconstruct how the research subjects ascribe meaning to their world, thereby imbuing it with purpose and engaging in purposeful action (Lueger, 2000). For social models, this represents the difference between explaining how and understanding why social phenomena emerge.

In order to incorporate the data types provided by QSS into ABM, this data must be considered relevant and meaningful for ABM to understanding a system under study. This transfer of new data types to ABM is, however, not easy. We hypothesised that zombies, as agents, would facilitate this transfer because they are easy to understand and exhibit simple behavioural patterns (see Lauro & Embry, 2008). Thus, ABMs' explanations for large-scale zombie behaviour are likely to match the understanding of why zombie behaviour takes place from the perspective of QSS. Zombies could thereby represent the "missing link"[1] between the lifeless computational models of populations, and the human actor meaningfully engaged in social life. With this approach we examine the openness in ABM practice to incorporating the types of input that qualitative social science can provide.

2 Methods

This research was conducted in collaboration with a Masters seminar on ABM at the University of Natural Resources and Life Sciences in Vienna. During the semester a competition was organised, in which the students programmed models of "Zombies vs. Humans". In advance of the competition, we organized a half-day "zombie-workshop" for a group of the participating students. A set of role-play exercises enabled the students to adopt the perspectives of their agents, i.e. zombies (roleplaying humans was considered unnecessary). We observed the workshop and were given access to the results of the programming competition. After the competition, we held qualitative interviews with all four students who participated in the workshop, with two students who did not participate, with the course lecturer, and two workshop volunteers. These materials form the basis of our on-going qualitative content analysis.

3 Results

Initial results showed that the workshop participants gained a deeper understanding of their agents (e.g. their constraints and motivations), as a result of the workshop. However, the participating students did not perform better than non-participating students in the modelling competition. Both the students and the responsible lecturer felt that it was not possible for the students to transfer their new zombie understandings to the models themselves. The

[1] Zombies are widely used as metaphors: For examples see Lauro and Embry (2008), Boon (2007) and Dendle (2007).

setting of the workshop and the competition, lack of programming skills, power relations, and a broader gap in terms and methods were provided as obstacles for the transfer of knowledge to the models. Workshop participants were more aware of these obstacles, and considered them limitations of ABM, than non-participants. Both participating students and the responsible lecturer valued the role-plays for introducing new knowledge and providing inputs in ABM, which could lead to better models. Providing the opportunity to reflect upon the experiences, a more direct relationship between the role-play and the model, and a more flexible model setting were identified as possible factors that could improve the transfer of knowledge from the role-play to the ABM models.

4 Discussion

From our findings it is clear that zombies did not succeed as a vector for bridging the gap between QSS and ABM. Our basic assumption that the simplicity of the zombie agent would ease the transfer of QSS data to ABM models proved untrue. This led us to question whether the simplicity / complexity of the agent was a decisive factor in the transfer process. According to our initial results, two key steps were necessary to bridge the gap between qualitative social science methods in ABM: 1) generation of new knowledge about the agents being modelled, and 2) transfer of new knowledge to the computerised model. The zombie workshop, with its role-play exercises, was successful in producing a better understanding of the motivations and limitations of the zombie agents.

However, the workshop itself did not facilitate the transfer of new knowledge to the students' models. We identified two categories of obstacles. The first category, which included the setting, space for reflection etc., resulted from the execution of the workshop and seminar, and was not necessarily reflective of broader obstacles in the QSS and ABM environments. Participants described the second category of obstacles as a deeper methodological and terminological gap between QSS and ABM. It was this methodological gap that we had hoped zombies could bridge. The fact that the workshop participants were able to recognise that this gap existed, encourages further research to find possible bridging mechanisms.

5 Conclusion

The gap between ABM and qualitative social science consists of the difference between, explaining how and understanding why large-scale social phenomena occur. We used zombies as a metaphor for human agents, working under the hypothesis that simple agents would more easily bridge the gap between these two approaches. The zombie agent must, however, be put to rest. The simplicity of the agent did not appear to be the decisive factor in the transfer of QSS data to ABM models.

A positive result of the study was that the process showed that role-play is a promising and fruitful method for incorporating input from QSS into ABM, by helping modellers better understand their agents. These modellers may be encouraged to find ways to transfer this knowledge to their models. In collaboration with social scientists, they could contribute to the further research that is needed to understand the remaining obstacles.

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Valentin Fiala was born in Vienna and grew up in Horn near the border to the Check Republic. After finishing School of general education, civil service and working at a school for disabled children in Kundapura in South India he started studying at the University of Natural Resources and Life Science in Vienna. He finished a Bachelors degree and an individual Master Degree. Currently he is doing his Phd at the Working group of transdisciplinary research at the Division of organic farming. There he is focusing on the adaptive capacity of farmer associations. Besides that, he is also a filmmaker and likes Zombies.

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Rebecca Paxton grew up in a rural village in Norway, before moving to New Zealand to begin studying in 2004. She completed a BSc with a double major in Environmental studies and Development studies, and a BA in International relations at Victoria University of Wellington. She then moved to Christchurch, NZ to undertake an Honours Degree in Hazard and Disaster Management at Canterbury University, before returning to Victoria University for a Masters in International Relations. During her studies she developed an interest in agriculture and the many social, environmental and technological systems with which it interweaves, and this led her to begin a PhD study with the Department of Sustainable Agricultural Systems at the University of Natural Resources and Life Sciences in Vienna, Austria, where she also works as a research assistant for the working group of Transdisciplinary Systems Research. She likes Zombies.

Jonas Oßwald

Jonas Oßwald was born 1987 in Schweinfurth, Germany. After grammar school he started a Bachelor of Science at the Faculty of Forestry and Environmental Science at the University of Freiburg. There he focused on computer simulation methods and modelling of ecosystems. In 2011 he undertook a one-year stay abroad via Erasmus at the University of Natural Resources and Life Science (BOKU) in Vienna, Austria. At BOKU he further deepened his knowledge of computer simulations, but was also introduced to the philosophy of science. On completing his Bachelor Degree, he consequently joined the Master of Arts program “Wissenschaftstheorie und Wissenschaftsgeschichte” at the Faculty of Philosophy and Education at the University of Vienna. In addition, he continues to work in research projects that deal with the simulation of ecosystems. Beside this his scientific interests are at the moment feministic theories on philosophy of science and the Narrativety of Science. He likes Zombies.

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The emergence of an EPS in times of crisis

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Abstract: This presentation constitutes an overview of a research in progress on the role of the new media in the configuration of public sphere(s) in the current economic, political and social crisis in Europe.

Keywords: media, crisis, EU, (european) public sphere, social systems design, systems theory, unity through diversity, emergence.

1 The emergence of a European Public Sphere in times of crisis

Europe is facing today one of the worst and challenging crises in its recent history, a crisis which is not only economic, but also social and political. Within this disordered context, the discussion about the role of the media in times of crisis has deliberately increased. The aim of this presentation is to shed light on the ways in which debates on crisis (its causes, contexts, implications, solutions) are constructed and explore the ways in which the media contribute to the configuration of the public sphere. In order to achieve this goal, an emphasis to the role of the social media will be given, which play a prevailing role in the structure of society and the formation of new public spheres in comparison to the press. Due to the insufficient state of the art of systems thinking regarding the public sphere, this presentation attempts to bring together different theories of public sphere into one grand consistent framework. Therefore, my contribution will be the integration of these approaches into a whole and the establishment of a broader notion of public sphere by employing the systems-theoretic principle “unity through diversity”.

The current crisis reveals that leading parts try to strengthen their power in European society. The mass media (and especially the press) reinforce this procedure by giving power to the elites and promoting polarization. The questions that arise are: in which ways do the old (press) and the new media provide pluralistic accounts of forms of deliberation on crisis in Europe? What kind of public spheres emerge though their treatments in times of crisis? What do the old and the new media tell us for a European Public Sphere and European democracy as well?

This presentation consists of four parts: the first part provides a general assessment of the relationship between media, public sphere and crisis, in order to create a framework for the role of the media in the social systems design. The second part evaluates media framing of the crisis in three European countries (Greece, Austria, UK) and underlines that the press is reluctant to provide broader thinking about the European crisis to the people. The third one looks at the ways in which social media structure society and activate critical events. The last part stresses that the evolution of the European system could undergo change by integrating the new media to the old ones. The emergence of a new social structure in Europe may contribute to the building of a new European Public Sphere and democracy.

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Wicked social systems reorganized by benevolent social behaviors

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Abstract: This presentation aims at explicating the oneness of problem and possibility, inner system and outer system, social system and social behaviors. The author integrates Banathy's (1996) and Senge's (1990, 2000) systems thinking and enriching wholeness thinking with Chinese mindfulness tradition for probing and resolving the wicked social systems observed in Taiwan. She systhesizes the numerous benevolent social behaviors enacted by the divergent green communities from the wholeness-praxis perspectives, and pinpoints how the wicked social problems could be transformed and societies could be interconnected with collective mindfulness and generative acitons.

Keywords: Wicked Problems, Social System Design, Benevolent Social Behavior, Mindfulness

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1 Oneness of inner system and outer system

When the emerging social and global problems become more and more and complicated, we might still be dependent on our past experiences to manage them without recognizing the inadequacy of our professional, yet fragmented knowledge. Even though we are in great need to search for creative collaboration across various disciplines and more systemic approach to tackling the highly intertwined problematic issues, we still tend to choose quick and easy solutions without taking into serious account their side effects.

In reference to Stafford Beer's vision that human beings are imprisoned by their own thinking, Banathy (1996) attempts to construct social system design models to expand our cognitive power and enhance our ability to deal with complexity. He found that traditional science defines complexity by examining the multiple components within a system, whereas systems science defines complexity by the interaction between the system and its environment, and by the interrelationship between system components. He argues that through synthesis and expansion we can better understand the systems and their relationships to larger systems or environments. Meanwhile, we should shift our attention from predicting and controlling our environment to understanding the uncertainty and complexity of the environment.

Senge (1990) translates complexity of reality into simplicity of wisdom by identifying and redirecting systems archetypes. He regards systems archetypes as powerful tools for converting complicated problems into simple communicable language. From Senge's systemic views, self and others are inseparable, the purpose of applying systems thinking is not to depict the details of the component systems, and relationships among major and minor systems, but to frame and reframe our own problems by situating ourselves within the systems for better understanding. However, both Banathy's and Senge's approaches might not be adequate for coping with the habitual power of human thinking and action, neither do they deal with the numerous problems resulted from the distorted human interpersonal relationships in the chaotic societies. Therefore, I would clarify the complexity and chaos in the outer society and those in the inner society, and how they might interact with each other. For example, The holistic approach taken by the traditional Chinese physicians, though demands synthetic experiences and longer process of recovery, reveals mutual adaptation and harmonizing between inner systems and outer systems. It aims at directing the patients to realize the causes to their illness and thus provide them with more integral treatment.

2 The critical role of benevolent social behaviors

In a community or an organization, especially nonprofit, how could people with different mentalities, visions and paradigmic thinking work out their challenging problems together? Theory of Human Social Behavior Orientation by Bowles & Ginitis explicates that in a steady society, people's social behaviors could be categorized as selfish, altruistic and reciprocity in the proportion of 38.2%, 24.6% and 37.2%", and 11.1% of them might shift to Shirk under certain circumstances (2005a, 2005b, 2011). The proportion change between selfish and altruistic is not big. But the reciprocity group is potential to grow with more engagement in environmental protection, community development, civil movements, social interaction and cultural integration. By and large, the proportion of reciprocity group in a healthy society is higher than standard value; and the proportion of Shirk is lower than standard value. On the contrary, the proportion of Reciprocity in an unhealthy society is lower than normal value; and the proportion of Shirk is higher than stardard value. Based on this theory, the proportion of the selfish group plus shirk group would exceed 60%, yielding to evil quality embedded in various social systems. The proportion of Reciprocity group could thus be regarded as an important indicator to determine whether a society is healthy enough (Bowles and Ginitis, 2005a, 2005b, 2011). Bowles and Ginitis contend that reciprocity behaviors possess the value of social justice, including getting reciprocal, interaction, reciprocity or the golden rule “We must treat others as we wish others to treat us”. Reciprocity behaviors manifested in this golden rule not only embody social just value but also highlight the common core of great religions.

Likewise, when community/organizational leaders are engaged in cultivating systemic or integral thinking for emerging possibilities, they, as well as the stakeholders, would need to undertake both divergent and convergent dialogues on infinite mastery of problems and possibilities for awakening a collective consciousness of shared wholeness. This ultimately would help enhance the wholeness spirit for nurturing a more sustainable world. As more and more people come to realize William James’ famous quote, we are like islands in the sea, separate on the surface but connected in the deep, the wholeness nature of diverse cultures and values will be more deeply appreciated. Hubbard (1998) also emphasizes that new economic, social, educational, environmental, and political systems naturally emerge out of the wholeness consciousness. What seems (and is) impossible in self-centered consciousness is natural and normal in cosmic, whole-centered consciousness.

3 Transcending wicked social systems with collective mindfulness and generative actions

According to the wholeness-praxis paradigm for organizational transformation by Li & Lin (2011), involutionary transformation focuses on observable problems, quick and short-term solutions, cost-effective investment; and consensus reached through superficial participation. Evolutionary transformation is undertaken in view that competing forces between problems and possibilities, and the co-existing, unending cycle of problems and solutions, organizations tend to take the evolutionary approach to transform problems despite its incremental effect.

Organizational leaders with revolutionary transformation are those who are adept in envisioning the wholeness of two seemingly contrasting and conflicting driving forces. They might not be willing to be confined within the problem realm, and tend to determinedly enact any change with quantum effect. They are the adventurers of revolutionary transformation in an organization. Genevolutionary transformation could arise from human’s collective consciousness, inner growth and holistic wellbeing of an organization. When organizations come to grip with the positive energy flow and the synchronicity of deep consciousness, they would enter the holo-volutionary transformation stage. Laszlo’s (2001) claim for global consciousness also shed great light on the essence of reciprocity. That is shifting (1) from competition to conciliation and cooperation, (2) from greed and deficiency to abundance and carefulness, (3) from external authority to inherent appreciation, (4) from separated parts into whole, (5) from machinery into an activity system, and (6) from division of organization into the integration of consistent all.

In this presentation, the author will inquire the nature of collective mindfulness and generative actions through creative collaboration with four organizations endeavoring in environmental education. The author will also present the green silk road project, which integrates the divergent social innovations enacted by these organizations. It is expected that such a project would explicate how wicked social problems could be transformed and even resolved.

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Anxious knowing: the severing of information from noise

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Abstract: Together with Bolzmann and Maxwell's statistical physics, Shannons' theory of information has encompassed our understanding of complex systems in a great array of domains, at all scales of reality: from micro-physics to eco-biology as far as revealing the noise of the genesis of the cosmos. The quantitative notion of noise and information has thus given the natural sciences a language with which to expand our empirical understanding of physical reality in a way that appears to have consigned metaphysics to the cabinet of curiosities of thought.

Keywords: systems, information, noise, metaphysics, Simondon, Shannon, Bolzmann, interdisciplinarity, transdisciplinarity.

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The commonly accepted notion of information, both in everyday language and in scientific discourse, has to a certain extent adopted this quantitative concept of information from its cybernetic context, but without a critical awareness of its full epistemological and ontological implications. Jose Maria Diaz Nafria's example in 'What is information?' makes the implications of this purely quantitative measure of information abundantly clear:

> *Just one binary digit may tell us if the universe is about to collapse, thus being very informative, and all millions of terabits on the web may just as well be generated by the whim of electrons in a rheostat, being thus completely uninformative.*[1]

This lack of semantic differentiation in Shannon's definition of information is *anxiogenic*: we must cut through the undifferentiated noise and analyze, differentiate, interpret and judge if knowledge is to arise. Meaning becomes the apparent bulwark against the constitutive uncertainty of knowledge. We want more from information than the wavering decision, the gamble on which part of complexity may become useful, as entropy of the message rather than noise in the channel of communication. The desire for signification expresses the hope of securely grafting knowledge onto its substrate, which is nothing but indifferent infinity.

But how are we to be sure that the complexity we expel from potential knowledge as mere noise or perturbation will not be our downfall, because it contained the determinants that made all the difference? The history of the natural sciences has indeed been jolted into action more than once by phenomena that were previously discarded as marginal perturbation, as mere noise. Many an experimental perturbation has led to the paradigmatic recasting of scientific theories, like for instance the Zeeman-effect, which led to the acknowledgement that the hydrogen atom, the simplest of all atoms, is already a complex entity. For Bachelard it is therefore:

> *[…] as a matter of fact, the very idea of perturbation that will have to be eliminated eventually. One won't speak any more of simple laws that are perturbed, but of complex and organic laws that are sometimes touched by certain viscosities, certain effacements. The previous simple law becomes a simple example, a mutilated truth, an unfinished image, a sketch copied onto a chalk board.*

The present paper will investigate the role of the decision in the judgement that severs information from noise and thus wrests knowledge, temporarily and precariously, from the white noise of absolute indifference of being. It thereby reintroduces fundamental metaphysical categories of the limited and unlimited nature of being into a discourse on information that had all but dispatched philosophy to the dusty shelves of the history of thought.

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Cecile Malaspina has obtained her Masters in Contemporary philosophy and critical theory at the Centre for Modern European Philosophy, London, after training as a curator in contemporary art (MA RCA). She lives in London and is currently a PhD candidate at Paris 7 Denis Diderot under the supervision of Prof Alain Leplege and Dr Iain Hamilton Grant. Her thesis topic is the relation between information and noise in the context of contemporary philosophy. She is currently translating *La methode: la vie de la vie* by Edgar Morin and *The Mode of Existence of Technical Objects* by Gilbert Simondon.

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Cybersyn project an object of learning for the future

Henry Mauricio Ortiz Osorio

Abstract: During the government of Salvador Allende, Chile implemented a paradigmatic system of control and regulation of production, emerged from the need of controlling and knowing the Chilean nationalized industry in relation to the needs it has to provide.

Allende believed that the transformation pathway to socialism could be different to those that had existed and he suggested a model of integration with the worker as the core of management processes and decision making.

In that sense the Cybersyn project was designed with the goal of having a decentralized state control of the industrial production able to attend properly and timely real needs. Starting on real-time information that would anticipate and correct potential incidents before they even occur.

The project provided valuable information on the nationalized companies for coordination and operation, being a political tool of vital importance for Allende's government for which decision-making issues reach the most proper level. Latin American current processes of social disruption allow us to analyze the historical perspective of this project to find parallels, similarities and common points that allow us to extend the analysis of industrial relevance of these cases. Furthermore, the current political, economic and social reality has evolve in such a way that the Cybersyn model requires an adaptation to new relevant complex features of the social system which challenge its practicality.

Keywords: Keyword; Keyword; Keyword; Keyword; Keyword; Keyword; Keyword; Keyword; Keyword; Keyword; Keyword; Keyword; Keyword; Keyword; Keyword; Keyword; Keyword; Keyword

On September 4, 1970, Salvador Allende was elected president of Chile, his election was adjusted to the rules of the existing democracy. He presented himself as a candidate for the movement's Popular Unity (UP). He won with a margin of less than 2% on the next candidate, Jorge Alessandri Rodríguez. The government of President Allende would be determined by the decision to make deep changes in the economic model of the country. Allende outlined an alternative way to the classical construction of Socialism, called by him "democratic socialism." His approach advocated the use of institutional channels to take government power, and act within the institutional framework to modify the same. He questioned the approach of classical socialism, did not agree with the overthrow of the state by using violence and ignoring the institutions of the old establishment.

At the time that Allende took office in Chile, the Soviet Union was in direct confrontation with the United States and the Cuban Revolution had taken place a few years ago. Latin America was close to an inflexion point that finally opted for the so-called “economic liberalism" but whose main characteristic is foreign interventionism and submission to the interests of finance capital, which strictly speaking would have nothing to do with classical liberalism.

The entrance of Allende as President of Chile was a clear message to the State Department of the United States, chaired by Richard Nixon: this country –Chile- would be closer to Soviet interests than American interests.

As Allende arrived to the “palacio de la moneda”, assumed a difficult task: to nationalize a major part of the economy. He began to nationalize strategic sectors of the economy. Mining was the main objective of Allende, because of its large relative weight in the Chilean economy and its political relevance.

These politics were contrary to the view that would be dominant, liberal economics, where the main objective is to achieve maximum benefit. Allende had an economic plan that had as pillars the satisfying of the needs of the people overhead of corporate profits, he maintained that the way to socialism not only be the appropriation of local wealth that were in the hands of foreigners, but also should be ended structure that held a few families with monopoly industries.

Because of this, Allende was conscious of the need to make use of all available technologies, therefore the Chilean government has its first direct contact with the field of cybernetics in 1971.

In the first year of Allende, expansive spirit Keynesian policies were applied, increasing wages, taxes, and expanding spending to stimulate economic growth, as consequence the GDP was over 7%, and production grew over the historical average. As a consequent these policies produced a rise in inflation and glimpses of scarcity, logical consequences of a short-term economic restructuring plan of this type, but definitively not in the medium and large term. By the end of 1971, Chile had nationalized a considerable number of the mining companies, and in turn a large number of private industries. However, the plans were not fulfilled completely, because most of the nationalized industries were not in the initial plans. The process required a consistent structure and delimitation of projects. The nationalization plan became a complex problem for the government.

Contradictions also emerged when appointing the new directors. The growth of nationalized industry made the situation complex and difficult to control. In some cases, parts of the UP, complained that the new directors acted as their predecessors, and had a similar lifestyle -life luxury and despotism- which conflicted with the principles of the UP government.

Fernando Flores the technical director of the Corporation for the Promotion of Production (CORFO), the agency responsible for the nationalization of industry, knew the British cybernetician Stafford Beer due to his studies of the principles of cybernetics and operations research (Medina, 2006). Owing to the challenges faced by the Chilean economy Flores contacted Beer, and told him the desire of the Chilean government to implement the principles of cybernetics in the government of the industry. Beer accepted immediately and started to work on this idea. For November 1971 he had his first meeting with Allende, where he outlined to Allende the scope and expectations of the project.

Beer had no higher education, but he had worked for a long period in the British steel industry. After World War II he joined as a laborer, was working there and way up to become director of operations research, he studied cybernetics by himself and practiced this in the industrial sector, specifically cybernetics management, although he had retired from the industry to devote oneself to academics.

After him contact with Flores he presented to CORFO the management system that integrated the principles of cybernetics, this would be the Cybersyn ('Cybernetics ' and ' Synergy ') project seed. The system was based on Beer's ideas reflected in the book “Brain of the firm" where Beer described a “viable system model” which, according to Beer, “existed in all stable, biological, mechanical, social organizations... ". He argued that the abstract structure of the VSM was applicable to a lot of different types of contexts. The idea filled the Flores expectations and the work began, consequently, Beer started to study the Chilean economy while the team that would create the Cybersyn project studied the book and the ideas of cybernetics of Beer.

This model "VSM" was established on the idea that the input variables of a system determine the state of the resulting system, and the number of possible outcomes determined the "variety" of the system. When the variables of the whole system were within normal was known as a state of homeostasis, in reference to a domestic stability. It consisted of five levels, the first three levels were responsible for the daily operations, while the last two (systems 4 and 5) were responsible for the future development of the project in the direction of all enterprises (Medina, 2006).

The lowest level, the system 1, is responsible for controlling the flow of raw materials, and production rates. Provide information about the input and output operations of the process based on the production system. System 2 contained the information channels and bodies to complement and enable the transfer of information from the system 1. System 3 represents the structures and internal controls to set the rules, resources and responsibilities of system 1, and to establish interaction with systems 4 and 5. Under normal conditions, the three basic systems could establish a complete management to productive activity. Exceptionally enter higher operating systems.

In system 4 relationships of the whole system with the outside were observed and feedback variables were reviewed, appropriately to be adapted to specific situations and the set 5 - the lowest level actions high - was represented the Controller appointed to determine the direction of the entire company and the objectives of production. According to Beer, the 5-level model containing the basic outline of all viable systems in turn he held that the entire system could be found at every level, " Brain of the firm" in biology is described as DNA replication found in all cells. He argued that the state, the company and the worker, all kept the same structural relationships. If you could design a theoretical model that worked, it could then implement from the most local level, as a section of an industry to the presidency of the republic.

Having designed the theoretical model study of computer resources that Chile had made . By that time, Chile was one of the countries with less computing resources Latin America. Counted for the project with a network of telex satellite tracking and some computers. With the resources available they decided to use the network of telex to receive reports "real time" of the state of the industry in order to exploit a process of making really efficient decisions, thus industry regulation would serve the whole society and not interest of a few individuals. The idea of industrial coordination was, and is, paradigmatic. Production planning is certainly a highly complex task, requiring the coordination of thousands of people and the definition of variables and objectives that aim to meet the needs of a particular society. To try to get it, Beer devised a measurement system that included variables from the levels of production and consumption to measure employee satisfaction in the rate of absenteeism. With this system of variables, which were condensed into ten for each company could determine what the status of each of the industries and in turn each industrial sector to determine what the status of the entire state industry. By controlling these variables each industry maintained a high level of independence, an idea that was vital to Allende. When one of the variables, at any level, indicated that there was a fault, a warning is given, so that the head of such level in a given time make the necessary corrections. If after this time, the failure was not corrected the problem was reported to the next level to be corrected there. The system raised issues that could not be resolved to a designated by the presidency of the republic if necessary.

The team used a telex network for communications between companies, sectorial committees, management of CORFO and the headquarters of the government. The telex network operated under the logic of the current Internet, which is the transmission of information at high speeds, however, have poor communication only supported a report by business daily, and however at that time and those resources was a breakthrough.

Based on this system of succession in the decision-making project design consisted of four so-called sub - projects: Cybernet, Cyberstride, Checo, and Opsroom that emulate the "VSM” is Beer. The first, Cybernet, was to use the telex network for real-time monitoring of each business. This control may seem contrary to the idea of individual freedom Allende, however, this control was limited to external observation, the results day, which was framed in the idea of a centralized economy. Cyberstride collected the set of software used for management of Cybernet, to and from each of the state enterprises. Czech, short for ' Chilean Economy' never materialized, but it was a mathematical and statistical model sought to model the behavior of the Chilean economy to predict their behavior and likewise seek solutions before problems are presented, finally Opsroom was a space from which it is intended to control the whole project consisted of seven chairs with simple systems for any type of worker could hold those positions interface, Opsroom room only materialized in a prototype. When Allende ordered relocate the headquarters of the palace CORFO currency and sought to materialize this stage the coup of 9/11 that would end the Cybersyn project, the military command of Pinochet did not understand and he decided to dismantle it.

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About the Author

Henry Mauricio Ortiz Osorio

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III C 2
Transdisciplinary responses to global challenges

Chairs

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Past approaches, including modernistic and post-modernistic ones, have partly failed to deal with the global challenges, as the nature of modernistic approaches most often consist in various forms of subject area specific reductionisms attempting to reduce complexity to simpler forms and models; be it physical elements (mechanism), or computational of informational elements (pan-computationalism or pan-informationalism) bypassing subjectively and intersubjectively based meaningful experience To the dilemma of modernisms attempts to reduce our complex world by erasing the diversity of reality, the answer of postmodernism has been to construct “little narratives” with no demand of coherence or truth giving up on basic claims of science. We need to find ways to integrate third-person and first-person views with technology through combining systems theory and cybernetics with more phenomenological, hermeneutical as well as semiotic and linguistic interpretive frameworks by enlarging the scope of reality to include not only physical things and objective information, but develop transdisciplinary frameworks capable of integrating physical, biological, perceptual, experiential cognitive, linguistic and cultural-social communicative systems without reducing one to the other.

List of Contributors

Liguo Ye: Ecological civilization as a possible route to post-industrial civilization: a dissipative structure far from equilibrium state

Katherina Zakravsky: How external memory banks (hence “culture”) make humans fragile or on knowledge as enemy of intelligence

Liqian Zhou: Signal, code-duality and information: information as the bridge between two cultures

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Biosemiotic transdisciplinary concept of information for global exchange

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Living organisms can be described from a natural scientific as well as a phenomenological-hermeneutical humanistic type of knowledge system. Organism's genes and physiology as well as their experiences, learning capability and social role have causal influence on their behavior. As such the general study of embodied life falls between the traditional organizations of subject areas grouped in Snows two cultures of sciences and humanities. A central problem is that this two-culture-view lacks a common epistemological and ontological framework. My view is that If we want to define a universal concept of information covering subjective experiential as well as intersubjective meaningful communication in nature, technology, society as well as life worlds - then the main problem is, which epistemological, ontological and philosophy of science framework the concept of information should be based. I do not find the arguments fore the core of reality across nature, culture, life and mind to be of a purely mathematical, logical or computational nature convincing. Therefore the core of the information concept should also include perception, signification and meaning construction in its foundation if we are going to produce a true transdisicplinary framework for encompassing nature, technology as well as embodied meaningful cognition and communication. To include the phenomenological and hermeneutical aspects as foundational will also open for a dialogue between the non-fundamentalist aspects of sciences, religions and political ideologies making the violent clashes between cultures less likely.

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System-Thinking-Activity Approach: thinking response to global challenges

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Keywords: the Moscow Methodological Circle (MMC); systemic situations; system-thinking-activity approach (STA-Approach); organisational-activity game (OAG); moderation technologies.

1 The Moscow Methodological Circle: general features and principles of systems thinking

Exploring the systems perspective of response to global challenges we consider the answer of Russian systems thinking which was developed in the Moscow Methodological Circle (MMC).

MMC was organised and led for more than forty years by G. P. Shchedrovitsky (1929–1994). MMC was created in the USSR in the year of J. Stalin's death (1953) when logic and epistemology was the only area of free philosophical thought. Now it exists as the "Methodological Movement" and a few institutions associated with it.

MMC developed *methodological thinking,* which was characterised by the following general features and principles:

- holism and reflexivity in relation to the other approaches and types of thinking (in science, designs, engineering, socio-cultural and law studies, etc.);
- practical orientation (connections thinking-activity, using systems approach as the means for organising processes of resolving complex problems by multi-professional and transdisciplinary teams, etc.);
- reflectivity as practical orientation of thinking to itself: capability to re-construct and re-direct itself;
- the "methodological turn" from thinking about systems as objects to the process of thinking systemically.

The shift from objects to thinking which was mentioned above characterises MMC from the beginning. It corresponds to the shift of interest from "systems sciences" to "systems rationality" – as discussed in holistic systems thinking approach. This methodological turn has allowed MMC to formulate original vision of problems of the systems approach: not to investigate "systemic objects", but to conceptualise and resolve *"systemic situations" as a form of work with complex problems*.

MMC has offered *two complementary basic ways for resolving systemic situations* (Maracha, 2011):

- epistemological, based on the configuration method as a method of systems thinking;
- practical, using methodological seminars and organisational-activity games (OAG) as the methods of communicative systems practice.

Both ways include *reflective practice* carrying out both development of knowledge, and development of the activity/thinking-activity, providing completeness of knowledge development life cycle.

Conceptualisation of systemic situations in MMC includes two components (Schedrovitsky, 1971):

- *subject matter and object distinction* when systemic situations are considered as situations of presence of several subject representations of one object which need to be correlated and connected with each other;
- *"the scheme of multiple knowledge"* and *configuration method* based on configurator-model and/or configuration plan.

2 The scheme of multiple knowledge and configuration method

In the scheme of multiple knowledge we consider particular points of view on the object as "projections" (subject "cuts") – which are taken at various turns of a whole "multi-dimensional" object that should be re-created or restored on the base of the projections.

The restored complex object is called *the configurator-model*, and the method of construction of similar models – *the configuration method*.

Each "projection" in the scheme of multiple knowledge can be represented in the following two-level scheme based on *semiotic concept of knowledge* (Shchedrovitzky, 1966). The *first* level is formed by operating upon an object X by means of procedures Δ_1,Δ_2, ... The results of these operations are expressed in symbols (A), (B), which fixate and replace the content [$X\Delta_1\Delta_2$ ...] singled out in a special activity $\lambda_1\lambda_2$ – a formal operation on the symbols – and all this constitutes the *second* level. The results of transformations on the symbol forms of the second level are related to the object X. The original substitution and the reciprocal relation are represented by arrows from the first level to the second level and back. The symbol constructs (A), (B) and the operations $\lambda_1\lambda_2$ performed upon them may themselves – give rise to another levels to which new meaningful comparisons are applied; in other words, the symbols themselves become the things operated upon. On higher levels of the scheme we can use mathematical operations and models which allow us to deal with quantitative data.

How the configuration method connects with systems practice?

The configuration method is proved and involved into systems practice via *representing thinking as activity*. And "the scheme of multiple knowledge" is represented and recognised as the scheme of the multi-positional organisation of activity in which the thinking-as-activity acts as design/programme for resolving systemic situations.

3 Two forms of specific MMC Systems Practice

There are *two forms of specific MMC systems practice: methodological seminar and organisational-activity game (OAG).*

Methodological seminar as a form of collective transdisciplinary thinking has developed into a specific MMC systems practice, which allows to consider systems situations in the "here-and-now" mode. Step-by-step, having originated as a form of discussions within MMC, methodological seminars became *a specific form to discuss transdisciplinary problems.*

The systems approach was used and developed in MMC for organising processes of *resolving systemic situations with complex problems by multi-professional teams*. Finally, MMC seminars generated "a new way of organisation and a method for developing collective thinking-activity" – OAG (Shchedrovitskii & Kotel'nikov, 1988).

OAG was invented by G. P. Shchedrovitsky in 1979. OAG became a specific technology for work with large-scale systemic situations (e.g. reforms, etc.) via:

- performance of collectively-distributed thinking, and
- engaging activity of various subject knowledge carriers, operating with them in a mode of the multi-positional and transdisciplinary organization.

Interaction between representatives of different positions was performed not only on the basis of the cooperative organisation of activity, but also according to the principles of intellectual communications – *"thinking-communication",* which was considered as the aspect of *thinking-activity.*

Methodological seminar is a form of collective thinking implementing the configuration method. Initially the configuration method was constructed on the basis of *general activity theory (GAT)* as a *metatheory* (and consequently was 'imperialistic' and 'hard'). Vice-versa OAG method means formation of *thinking-activity space* in which a free, intelligent and responsible choice of the point of view, the way of action and the form of its discussion is possible. In OAG not only objectives and means, but also values and beliefs can be made problematic (so OAG can be considered as a 'soft' method).

4 Methodological foundations of contemporary MMC Systems Practice

Now MMC systems practice has *two basic methodological foundations: thinking-activity scheme and systems approach*.

In thinking-activity scheme thinking and activity are represented in the form of different "layers" ("*pure thinking*" and "*thinking-action*"), divided by a "*thinking-communication*" layer. Links between thinking-activity layers are mediated by *reflection* and *understanding* processes.

Thinking-activity scheme is the basic scheme of the *system-thinking-activity approach* (STA-Approach).

Systems approach in MMC practice allows to organise thinking-activity in a holistic way.

Systems approach in MMC practice involves *three concepts of systems*:

- 'System-1': natural "thing" systems;
- 'System-2': activity systems (Shchedrovitskii, 1988; Shchedrovitsky, 2002);
- 'System-3': socio-cultural systems, or systems with internal sense (e.g. institutions as a case of systems with internal sense).

Three concepts of systems are results of the different programmes and correspond to different paradigms of systems thinking.

Three MMC programmes are the following:

- 'logical researches of the thinking': thinking is considered epistemologically (as generating new knowledge) and as operations with the signs replacing objects of thought;
- 'general activity theory' (GAT) and 'system-activity approach' (SA-Approach (Shchedrovitskii, 1988; Shchedrovitsky, 2002; Dubrovsky, 2011));
- 'system-thinking-activity approach' (STA-Approach) and 'system-institutional approach' (SI-Approach).

Three MMC paradigms of thinking are the following:

- 'epistemological-semiotic paradigm': thinking deals with objects as natural systems;
- 'thinking-as-activity paradigm': thinking deals with activity systems;
- 'socio-cultural thinking-activity paradigm': thinking deals with socio-cultural systems.

In order to apply STA-Approach to systemic situations from practice we should use moderation technologies. OAG considered above can be considered as a system of moderation technologies.

In this paper we shall consider two cases (and types) of systemic situations where it needs moderation technologies in territorial development: state programmes implementation and clusters formation. Moderation technologies are considered as the mode of communicative management supporting adhocratic type of interaction and deliberative communication, i.e. the "horizontal" and not alienating interaction providing collectively-distributed thinking and multi-positional organisation of resolving systemic situations with complex problems by multi-professional teams.

In order to launch moderated communication between stakeholders of state programmes or clusters we should expand borders of operated system from regional economy to a complex of socio-economic and political processes in the territory.

For moderation of public and political processes in territorial development it is used the following technologies:

1) moderated forms of events organisation (seminars, "round tables", etc.);

2) process forms of workflow organization: project groups, foresight, OAG and similar forms (strategic sessions, staff games), civil jury and other forms of public expertise, etc.

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Application of ideas of purposeful system to a class of large-scale systems in the age of globalization

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Abstract: A model of global system including large-scale systems is suggested. The main purpose of the strategy is to hold the global system in an evolutionary corridor. Control, management, governance in each level of the scheme suggested have to be subordinated to harmony establishment between the poles of single and multiple incarnations of human being.

Keywords: large-scale system, purposeful system, global system, control, management, governance,

1 Self-governance and purposefulness of the Global system

In the course of globalization mankind creates and uses more and more complicated objects increasing to enormous proportions. They are called large-scale systems.

The scientific school of the Institute of Control Sciences of Russian Academy of Sciences presents the following definition: “Large-scale systems is the class of complex (large) systems, which are characterized by complex (interbranch, interregional) interaction of their elements which are distributed on the large territory, and are requiring significant expenditures of time and resources for their development. The typical examples of large-scale systems are: fuel and energy complex and its parts, transport, agro-industrial, territorial-industrial, regional and branch systems, holdings, financial and industrial groups, transnational corporations, distributed systems of information transmission and processing and other complexes” (Управление развитием крупномасштабных систем, 2012, p. 5). It’s a working definition, not claiming logical rigor. Since 2007 the annual International conferences on managing the development of large-scale systems were held in the Institute of Control Sciences (Russian Academy of Sciences). More than 1700 reports were presented at these conferences since 2007 and published in the “Proceedings”.

Limit case of large-scale system is the global system.

Global system is self-governing, but is it a purposeful system? “The object is purposeful if it can make: 1) the same result in various ways in the invariable environment and 2) various results in the same or other environment” (Ackoff, 1972) World economic crises, the steady depopulation of developed countries of European culture, the irreversible global warming and the degradation of the biosphere show that at present time it is not purposeful quite enough. It is necessary to find effective responses to above-mentioned global challenges.

Each large-scale system (a part of global system) is created with some specific goal. But at management, controlling, governance, directing, administering, steering, conducting, ruling, driving and so on with respect to large-scale systems the problem arises because the human being isn't able to comprehend distant consequences of its decisions.

2 A model of global system

From the times of Adam Smith management of industrial enterprises is based on economic laws. In the subsequent time management practice indicates that by increasing the scale of the industrial enterprise from some scale it is necessary to consider, in addition to the economic, some social processes. Consequently, the model systems used in management should be built according to their scale. Starting with a certain *scale of values*, the practice of developing systems is beyond household and economy. It needs more complicated models and instruments. The population undertakes economic activities, and we can agree that this fact is significant. Social actions are also important, social actions add up to historical events. Still, the procreation activities or reproduction of the indigenous population is the base for the subject of history. The population, in fact, keeps house and develops the industry, reflected in the economic indicators, and also carries out social actions. It is important that the economic potential is not converted directly into a demographic success. Special "mechanisms" and long periods of time are necessary to make this transformation possible. It is a different area. The subjects of the regional or country scale come to the need to take into account in their work the actually present procreation-demographic and migration processes.

And finally, the planet as a whole is an arena of ecological processes, among which air, land surface and water pollution, melting of glaciers, sea level rise, reducing the area of habitable land are of high-priority.

After analyzing the empirical data, we propose to distinguish between four classes of systems that correspond to the following spaces: 1) the space of economic activities, 2) the space of social activities, 3) the space of history, 4) planetary space.

Borders of the specified system classes are indistinct. They are defined by conditional borders of human practices (for example, household and economics, social practice, historical practice, ecological practice) and academic subjects corresponding to them. The conventionality or penetrability of borders represents the following phenomenon. Depending on intensity of internal processes in concrete system, a stage of its development, personal psychological features of the people included in the system and other factors the considered system can appear on this or that side of the border of the system classes established by the researcher preliminarily. For example, in concrete system lines of household and economic or social system can prevail depending on the moment of supervision.

Through interactions in the human person household/economic processes in society have impact on social processes and vice versa. Inconstancy and relative weakness of these interactions allow to study, plan and realize household/economic and social practices independently on small time intervals in most cases. However it is impossible to neglect mutual influences between the specified types of systems (i.e. between the layers of global system) completely.

These layers are named above in the order of increasing spatial scale. The criterion for including the activities and the subjects which are undertaking it and also forming the relevant system into one or another class are sequential answers to several questions:

1) Is the purpose of the subject under consideration to achieve and/or maintain economic viability?

2) Is the purpose of the subject under consideration to achieve and/or maintain social viability also?

3) Is the purpose of the subject under consideration to achieve and/or maintain the consistency of procreation-demographic processes also?

4) Is the purpose of the subject under consideration to achieve and/or maintain environmental soundness also?

The global system can be represented as an aggregate of subsystems of these four classes that are "drawn on each other" (the term by V.A. Lefebvre – Russian/American philosopher, Leningrad, 1936) (See Fig. 1). For example, procreation-demographic processes display their strength on a national scale. Countries of the Globe are represented as sets of social groups which, in turn, consist of household/economic activity subjects.

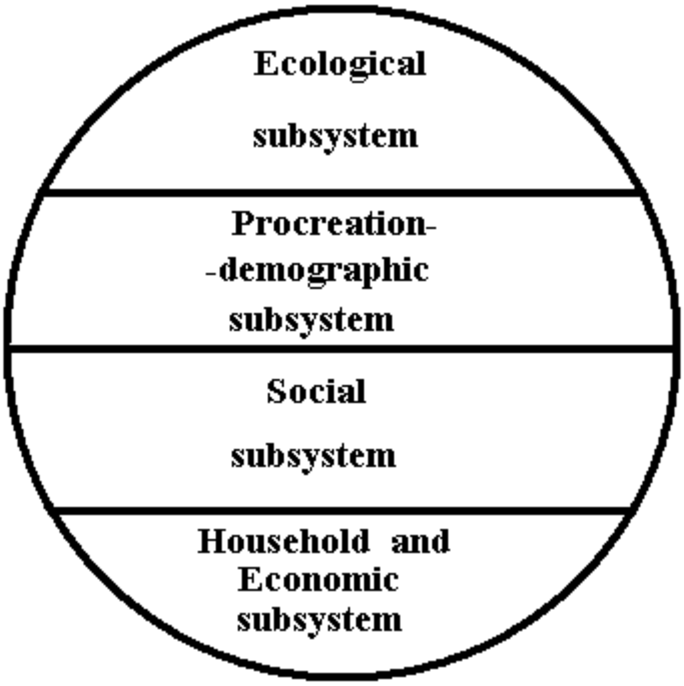

Fig. 1.

Figure 1: Schematic representation of the global system as an aggregate of units belonging to four subclasses "drawn on each other". (Peym, 2013)

DEFINITION: A large-scale system is an aggregate of two or more subsystems "drawn on each other" that belongs to different classes of the proposed classifier.

The global system is a conglomerate of purposeful large-scale (Ackoff, 1972) systems, "drawn on each other" (the term by V.A. Lefebvre). It is difficult to speak about the property of purposefulness of the resultant system as purposes of systems forming this conglomerate, aren't coordinated. These systems are formed artificially by managers of various scale levels of global system Figure 1. The initial base for them is the terrestrial surface. The biosphere was created naturally during evolution of the planet. The terrestrial surface and the biosphere are under continuous influence of artificially created large-scale systems. The person making decisions concerning large-scale systems has to consider interrelation and mutual influence between 4 levels of global system specified in Figure 1.

The processes of the two upper levels of the proposed classifier (See Fig. 1) are so slow that they are not detected by existing tools for strategic analysis and planning of national scale level. Managers at all levels use mainly economic indicators and levers. As a result of non-systematic use of economic "shockers" disturbances are increasing in the global four-level oscillating system. At the economic level we see market fluctuations with frequencies of cycles of Kitchin-Crum, Juglar, Kuznets, Kondratieff and so on. At the social level we note fluctuations of social tension, agitation and demonstration, revolutions, restorations, birth and death of political parties. At procreation-demographic level we trace the depopulation of developed countries of European culture, followed by demographic expansion of the peoples belonging to traditional cultures. At the planetary level we can fix an irreversible global warming and the degradation of the biosphere.

The large-scale system management/governance is a problem because the manager's concept about this system, arranged by means of a simple extrapolation of the market reality and bureaucratic practice does not correspond to the real structure of large-scale systems, formed by evolution process during long time.

Substantially these problems can be removed by means of *general activity theory* developed by the Russian philosopher G. P. Shchedrovitsky (1929–1994).

3 The anthropological turn

In our opinion the problem solution is connected with the anthropological turn in the ontological layer of the manager's (ruler's) consciousness. A new ontology of human being is to be considered as a limit ontology. Its scheme-principle includes two focuses: a focus of human being single incarnation and a focus of it's multiple incarnation. We use the system views of contemporary French philosopher E. Morin (1977). The focuses of the given model are included in the feedback circuit, which defines their mutual recursive conditionality. This feedback also provides ongoing reproduction of the system, mutual and reciprocal usage of it's focuses. Nature, technology, sociality, management, governance, etc are considered in this model not as independent entities, but as mechanisms and institutional arrangements that mediate the interrelation of single incarnations of the human and multiple one.

In accordance with the views of XX century philosopher N. Hartmann «the structure of the real world has a form of stratificated wholeness. Each layer is a whole order of things. There are four main layers in this structure: the physical-material, organic-living, psychic life, historically spiritual. Each of these layers has its own laws and principles. A higher layer of being is entirely built on lower one, but is determined by it only partly» (Гартман, 1988, p. 321). In the proposed scheme-principle named layers correspond to the following categorical pairs:

1) the human body – the totality of the surrounding natural conditions and factors;
2) individual – collectivity;
3) subject – a set of social institutions;
4) personality – society.

A subject is more primitive model of human being, than personality because a multiple form corresponding to it – set of social institutes – is more primitive, than society.

It is also promising to have in mind the possibility of extending the foregoing list by the results of investigations of a human being as a member of the population. This gives the opportunity to follow the link between separation – inclusion categorical pair and the procreation as a reproduction process of human being as a totality of his single and multiple incarnations.

Each type of culture presented in history, as well as the current position of culture on its life cycle trajectory is determined by proportions of single incarnation/multiple incarnation ratio in the beingness layers selected by the researcher.

Control, management, governance in each level of the scheme Figure 1 have to be subordinated to harmony establishment between the poles of single and multiple incarnations of human being.

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Challenges in protecting human health and ecosystems

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Abstract: This paper will address the procedures raised for protecting human health and ecosystems from impacts consequently to environment contamination, the evolution of such a process and its possibility of further development. On the other hand, examples will be presented of improvement in assessing risks to human and environment components resulting from chemicals with reference to our eco- systemic, integrated, approach.

Keywords: Environment and Health, ecosystemic approach, systems science, paradigm, complexity, vulnerability, risk assessment

1 Human and environmental risk assessment

This paper will address the procedures raised for protecting human health and ecosystems from impacts consequently to environment contamination, the evolution of such a process and its possibility of further development.

1.1 Procedures and limitations

It started based on the consideration that pollutants disperse rapidly in air or water. Accordingly, a lower concentration as a limit of environmental contamination, i.e. a simple division by applying a reasonable safety factor, would do it.

Such mode of calculation, on one hand, paid littler attention than at present to species that populate the ecosystem. On the other hand, it disregarded the possibility that human exposure to pollutant(s) can be much higher than thought, owing to their intake in the body. The entry of pollutant(s) in the food chain through ingestion is one of the routes, and processes such as bioaccumulation can occur at each trophic level, raising the exposure of humans. Inhalation and the dermal route can also contribute to exposure.

The process continued to evolve toward more protection. Owing to a progressive improvement of analytical methods and detection limits of contaminants, effects could be detected at lower and lower doses, leading to stepped reductions in what was considered as "maximal normal limits" for the human being. One started looking for the maximum permissible environmental contamination in one environmental compartment which could maintain the levels in the human body below the upper level not associated with unacceptable effects.

Further steps in the regulatory field included building a risk assessment framework, first for humans in the early eighties and next, in the nineties and with a rather similar structure, for the ecosytem, with closeness between the US and the European paradigms.

Nevertheless, regulatory toxicology and ecotoxicology addressed one pollutant at a time, one environmental medium or one source at a time.

The paper will discuss, next, the improvement to these procedures that have been pursued over the last two decades, to account for issues recognized in other European working papers or policies.

It will also pinpoint, that, despite these changes, a series of scientific and decisional challenges remains unresolved. We will address these issues in two different ways.

2 Toward an ecosystemic challenging approach

Different fields of knowledge have remained partitioned for a long time in classical environmental sciences approaches as well as in ecological or human risk assessment at the level of the decision sphere, which may have slow down the shift toward improved regulatory process.

On the other hand, examples will be presented with reference to our eco- systemic, integrated, approach. When examined within this framework, questions such as exposure scenarios and determinants as well as socio-economic and biological vulnerability matters, variation in susceptibility and other components get organized into several modes of assessment saving significant time and effort at various international or more local scales.

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A world of views: fragility and antifragility in sociotechnological evolution

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Abstract: It seems paradoxical that our ever increasing knowledge of the world and consequent technological progress makes human civilization more fragile. We analyze systemic principles of sociotechnological evolution in search for clues why it is the case and how can we change it. We define the concept of fragility and analyze why the current sociotechnological world system tends to become increasingly more fragile. We then define the concept of antifragility as the property of a system that thrives on volatility. Based on the lessons from biological evolution we introduce *A World of Views* as a framework for a future antifragile sociotechnological world system and discuss its necessary properties.

Keywords: accelerating change, antifragility, cybernetics, complex systems, diversity, experimentation, fragility, modeling, modularity, openness, worldview

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1 Our fragile present

It seems paradoxical that our ever increasing knowledge of the world and consequent technological progress makes human civilization more fragile. We analyze systemic principles of sociotechnological evolution in search for clues why it is the case and how can we change it.

1.1 Understanding fragility

Fragility is understood as the sensitivity of a system to external shocks that might weaken or break it. Fragile systems seem to characteristically dislike volatility of all kinds (Taleb, 2012). In cybernetic systems with multiple feedback loops, fragility is much more complicated than sensitivity to external perturbations. Fragility in such systems largely depends on internal mechanisms that potentially amplify minute disturbances (Minsky, 1977). In complex cybernetic systems it is critical to understand feedback mechanisms that may amplify fragility. In the context of human civilization, such mechanisms constitute an existential risk as unpredictable minor "shocks" can become seeds to system-wide cascades of catastrophic events.

1.2 Fragility - the consequence of a complex world

Large systems become progressively more fragile because current sociotechnological dynamics hosts a growing number of powerful amplification processes. This working assumption is based on the guiding principle standing at the root of all technological progress: "doing more with less". At the present stage of world-scale sociotechnological evolution, many negative effects of amplification become apparent having to do with the exponential increase of complexity in large systems (Helbing, 2013). The major factors associated with such increase are:

- **Hyper-connectivity** – A hyper-connected world is a world where every agent is connected by numerous means to many other agents and where distances, both in space and time tend to collapse (WEF’s Global Agenda Council on Complex Systems, 2013). The effect of hyper-connectivity is that local minor perturbations may swiftly spread and induce global, largely unpredictable and sometimes disruptive effects.
- **Reflexivity** – is a concept referring to circular relationships between cause and effect as each systemic element is both affecting and is being affected by other elements. In the sociotechnological context this means that patterns of modeling and representation have a decisive effect on the types of feedback loops that develop in the system. Inadequate representations make the system increasingly vulnerable to surprise events.
- **Accelerating change** – is a positive feedback effect influencing the speed of the overall system’s dynamics. As more information is fed to agents they produce more events in response, which in turn produces even more information for other agents. Accelerating change amplifies fragility because once the pace of events exceeds the capacity of the system to process information, the system becomes “blind” to improbable events, its adaptive capacity deteriorates and its fragility increases.

1.3 The Clockwork that never was...

We propose that the dominant factor of increasing fragility is an outdated approach to large scale sociotechnological dynamics. This approach seems to be rooted in what we call the Newtonian worldview (Heylighen et al., 2006). This worldview is a perception of the universe as vast deterministic clockwork whose interconnected components operate in concert with ultimate accuracy and efficiency. Though this perception was quite shaken by the discovery that uncertainty (Quantum theory), unpredictability (Chaos theory) and uncontrollability

(Complexity science) are inherent in every system, it is, to a large extent, still reflected in the way we model systems, structure organizations and design technological artifacts.

Just a few generations ago, in a world that was fairly stable and less hyper-connected compared to ours, the basic assumptions of the Newtonian worldview were fairly reasonable. Presently, however, due to the factors mentioned above, things get increasingly wilder. Models based on clockwork perception of the world become increasingly more difficult to construct while their predictive powers diminish significantly. We identify three major causes:

- **Failure of simplification methods** – Complex reflexive systems are difficult to simplify because many of the parameters affect each other in a circular manner making it difficult to disregard any of the parameters.
- **The future does not resemble the past** – Accelerating change means increased volatility so recurrent patterns that characterize the behavior of stable systems tend to disappear. Therefore, models that extrapolate future behavioral trends based on past recurrent behavior tend to fail.
- **Failure of statistical methods** – Statistical methods are using small representative samples in order to model large populations of agents and their interactions. Populations with well behaving distributions can be reliably represented by statistical models. Complex phenomena, especially human created systems and organizations, often acquire properties which are wildly distributed (Mandelbrot et al., 2010). Wildly distributed phenomena have no representative sample size that can be useful to model statistical regularities of larger populations.

As long as decision makers view the world as a deterministic, well behaved machine and ignore the increasing fallibility of present modeling methods under the current sociotechnological dynamics, our systems will fail in places we least expect. As models fail more frequently they result in ineffective governance and increased systemic fragility.

2 Our antifragile future

In a complex reflexive world system we will never manage to identify all the fragile elements and anticipate all failure modes. We need therefore a radically different approach: to introduce a dynamics where local failures do not cascade to global catastrophes but rather on the contrary, stimulate global strengthening.

2.1 Understanding antifragility

Taleb (2012) frames the problem we tackle as follows: "if fragile things seem to characteristically dislike volatility of all kinds, what would be the character of those things that are the exact opposite? " He calls such things antifragile. Resilient things would be at best indifferent to volatility. Antifragile things are not just indifferent, they positively love volatility, disorder, uncertainty and chaos. For a system as dynamic and complex as the sociotechnological world system, it is not enough to be indifferent to the unavoidable volatility. The system needs to thrive on volatility - it needs to become antifragile. Following the example of biological life, we can consider biology to be a different kind of technology. Like human technology, biology is also all about amplification: the species that succeeds to make more of itself with the least available resources is the species that fairs best. Biological progress is achieved via evolution and has produced systems of vast complexity. Yet, life at large is anything but fragile.

In the long history of life, failure is the rule while success is the exception as there are many more extinct species than living ones. However, life is consistently thriving in spite of all misfortune. What is it that makes life antifragile?

Natural evolution achieves antifragility via endless experimentation and creation of ever more options. Furthermore, while evolution easily disregards its failures, successful experiments naturally become the sources of new options. On the long run, the outcomes of successful experiments will be shared by many life forms because the more successful a species is, the more it will proliferate and originate new species. Life diversifies its investments such that failures are cost bound, while successes may have huge gains. The net effect of this strategy is that there are many more failures than successes but gains accumulated from just a few successes are much higher than the costs accumulated over many failures[1]. Evolution does not try to design or predict the outcome of its "experiments". Under circumstances of high unpredictability just retaining and distributing the successful results seems more effective than trying to predict fitness based on historical experience. We propose that this strategy presents a critical key in achieving an antifragile future of the sociotechnological world system. To adopt this strategy requires a paradigm shift in system thinking.

2.2 A paradigm shift - from control to experimentation

It is plausible that the future of the sociotechnological world system will converge into one of three categories of scenarios:

- **Systemic breakdown** – caused by a cascade of disastrous global events such as economic meltdown, environmental collapse, escalating local conflicts etc.;
- **Enforced cessation of technological progress** as governments try to avoid disruptive effects of accelerating change, giving up much of the immense benefits it might bring;
- **Abundance and flourishing** - Technological breakthroughs eventually open for humanity yet unimaginable horizons of prosperity, growth and transformation.

The key to increasing the probability of embarking a favorable path lays in overcoming the fragility inherent in the current sociotechnological world system. A World of Views is a viable paradigm aiming to achieve antifragile sociotechnological dynamics. As we progress, our artificial systems and environments become more lifelike: interconnected, messy and full of surprises. To adapt, we need to move away from the paradigm inspired by the Newtonian worldview to a much more organic and diverse one. Critically, it is a shift from governance based on predictive modeling to governance based on self-organization and experimentation. This shift does not suggest stopping to develop models, but we need to become acutely aware of their inherent shortcomings especially in regard to complex, volatile systems. Furthermore, it is essential that we eradicate our collective fear of failure and learn to encourage responsible risk taking and cultivate experimentation. The World of Views paradigm thus adopts a strategy similar to evolution: radical experimentation and diversification at all levels while ensuring that failures are kept localized (bounding costs) and successes are effectively distributed (multiplying gains).

3 A World of Views

A World of Views is a vision of a future sociotechnological world system that embodies a multiplicity of unique, modular and open co-evolving worldviews. In brief, a worldview is a

[1] This strategy is technically described by Taleb as a "convex pay function" (Taleb, 2012)

gestalt perception, both individual and collective, in relation to self, others, society, and the cosmos at large. Every worldview is essentially subjective, depending on the choices of the agents and communities sharing them (Cambell et al., 1982). From a societal perspective, a World of Views is a heterogeneous network of agents such as humans, technological artifacts with varying degrees of autonomy and cognitive competences and the social organizations combining them. Such organizations are self-organized assembled entities (DeLanda, 2006) whose operational dynamics is based on a shared coherent worldview and they embody an actualized expression of that worldview. A World of Views is a world that thrives and evolves thanks to its enormous diversity and variation of intelligences, their chosen embodiments, styles of expression and co-evolution in the form of multiple overlapping and fluid social institutions.

3.1 Antifragility and a World of Views

Based on their diverse premises, biases and values, the actualized embodiments of worldviews in the sociotechnological world system are cognitively competent agents able to interact in sociotechnological space in a manner analogous to organisms and species in their natural environment. A World of Views is a nested, modular self-organizing structure, where worldviews occupy the highest level of organization but in themselves are modular and diverse (Simon, 1962). Diversity, modularity and openness are the essential properties of worldviews that jointly characterize an adaptive structure capable of locally containing failures while swiftly propagating and distributing successes, thus realizing an antifragile system.

- **Diversity** – Entrepreneurship and experimentation at all scales will be the source of increasing diversity. Diversity leads to redundancy characteristic to organic systems but missing from clockwork systems designed to maximize efficiency at the expense of adaptability. Similar to biological evolution, every experiment will draw from the surplus wealth of an already realized success and diverge from it to explore further options. Experimentation is the mechanism by which the system is capable to convert surplus resources into operational freedom.
- **Modularity** – Worldviews will generally have a nested modular structure, where each module is a complex of concepts, perceptions and values that form a coherent and relatively independent whole. Communities holding modular worldviews will be able to manipulate modules independently. Thus, modularity allows for: 1) independent evolution of modules supporting the localization of failures; 2) sharing and exchange of modules, supporting amplification of success; 3) increased flexibility, adaptability and redundancy.
- Analogous to biological replicators, successful modules will proliferate being copied by many communities, consequently producing many variations of themselves in the process. Communities sharing and exchanging modules will mimic mechanisms of co-evolution such as symbiosis and horizontal trait transfer.
- **Openness** – Reflects the tolerance of a worldview to changes in its own structure and its capacity to constructively interact and cooperate with other worldviews. Openness is not an unconditional acceptance of other worldviews but rather tolerance and effective responsiveness towards them.

4 Conclusion

We propose that an antifragile world system is the only viable configuration that can effectively cope with the powerful disruptive effects of technological progress and the volatility introduced by accelerating change. A World of Views is a vision of the sociotechnological world system incorporating insights from biological evolution. It is a nested, self-organizing structure of extreme diversity and plasticity where worldviews occupy the highest level of organization but in themselves are diverse, modular and open. These essential properties jointly realize an antifragile structure.

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Ecological civilization as a possible route to post-industrial civilization: a dissipative structure far from equilibrium state

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Abstract: This paper suggests that ecological civilization should be a dissipative structural system far from natural equilibrium state created by control and management of complex ecosystem with its three subsystems: natural, economic, and social system. Ecological civilization is a description of the complex system mixed of ecological and social system which is constructed by human beings. It is applied to evaluate the relation between social and ecological system. Criteria of evaluating whether a civilization is ecological civilization include the health and sustainable achievement of the complex ecosystem services. The aim of ecological civilization construction (ECC), based on ecology, systems science and management science, is to achieve the control and management of complex ecosystem through input of information or negative entropy under reasonable metaphysical ideas. In paradigm of systems science (PSS), the system involved subject and object is a self-organizing control system and there are certain evolution laws in system. A healthy and sustainable system can only be achieved through adjusting behavior pattern of humans. As the subject of ECC, human control and manage it in and above the system. The object of ECC is no longer just a natural system, but an “open complex giant system” involving humans.

Keywords: Ecological civilization; Systems science; Dissipative structure; Metaphysics; Complex ecosystem; Ecosystem services

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Confronted with the ecological crisis caused by industrial civilization, Chinese scholars put forward the important idea of “ecological civilization” in the 1980s. But no unanimous opinion on the understanding of ecological civilization has been arrived in academia. The author thinks that this dilemma dues to lack of theoretical paradigm. The object of ecological civilization construction (ECC) is the relation between man and nature. The modern classic science concerns mainly thinghood properties as its object rather than their systemhood properties. Meanwhile, systems science focuses on the study of systemhood properties (Rosen, 2001, p.241-243), and it can explore the essence of harmony between man and nature by analyzing inner structure and then further the theoretical study of ECC.

1 “Four antinomies” of ECC

First, antinomy on human subjectivity. Anthropocentrism has been regarded as the main reason of ecological crisis. If guiding practice with anthropocentrism continues, it is bound to bring more serious ecological crisis; however, non-anthropocentrism will lead to the absence of constructing subjectivity or power loss.

Second, antinomy on constructing route: remaking nature or human itself. By reforming the nature to achieve “harmony between man and nature” is likely to bring dissonance. However, it will consequently reduce the degree of “civilization”, or even bring “de-civilization” trend if we change human behavior to cater for nature.

Third, antinomy on constructing measure: the better environment is protected, the lower the level of civilization is, i.e. inherent oxymoron, combination of contradictory terms (Cobb, 2007). The best protective measure is to restore pristine condition of nature，namely “the removal of human”. However, the pursuit of more “civilized” will be further away from the most natural state.

Fourth, antinomy on the relationship between ecological civilization and material civilization: ECC is bound to bring certain absence of material civilization. The view “nature is the best” (Commoner, 1974, p.37) has been generally recognized; therefore, ecological civilization requires human to leave nature alone. There is intrinsic conflict between maintaining "natural" state and the reforming model of development.

It is obvious that the above problems are very difficult to solve substantially in mainstream paradigm of ecological civilization, so a new suitable paradigm is required, accordingly systems science discussing the systemhood properties of system has exceptional advantage. Therefore, it is possible to resolve or dispel them in paradigm of systems science (PSS).

2. Theoretical connotation of ecological civilization

Generally, ecological civilization can be concluded as material civilization, system civilization and spiritual civilization of ecology. It is an advanced form of civilizations following primitive civilization, agricultural civilization, industrial civilization (Yan, 2009, p.237). Harmony of man and nature is the essential idea of it. However, these prevailing viewpoints of academia do not elucidate what the essence of harmony is, and what internal structure of system of man and nature can be called harmonious exactly. Therefore, the four antinomies above arise inevitably in logic. In PSS, a new viewpoint is proposed in this paper that “the ecological civilization is a dissipative structural system far from equilibrium state created by control and management of complex ecosystem with three subsystems which are natural, economic, and social system. Ecological civilization is a description of the complex system mixed of ecological and social system which is constructed by human beings. It is applied to evaluate the relation between social and ecological system. Criteria of evaluating whether a civilization is ecological civilization include the health and sustainable achievement of the complex ecosystem services". This definition suggests the representative index of ecological civilization is no longer of thinghood properties, but of systemhood properties while describing the existence of system from the perspective of systems science.

Accordingly, based on ecology, systems science and management science, the ECC is to control and manage the complex ecosystem through input of information or negative entropy under reasonable metaphysical ideas, .The four antinomies above can be solved or dispelled by the reinterpretation in PSS. Firstly, how to dispel subjectivity problem. The starting point of ECC is not for human itself but for system's health. "Sustainable services" in ecological civilization requires subjectivity of human during the process of ECC. Secondly, how to dispel constructing route problem. The control and management of system for its health are implemented only through transformation of the human oneself in the system. Thirdly, how to dispel constructing measure problem. The ultimate aim of ECC is not a stationary point, but a kind of dynamically stable structure, or a dynamic attractor. Protecting environment requires changing measure from linear to nonlinear. Fourthly, how to dispel the problem on relationship between ecological civilization and material civilization. As a part of complex ecosystem services, achievement of the material wealth must be within the limit of system health, otherwise, it will impair health of complex ecosystem.

3. The metaphysics of ECC

Reasonable metaphysical idea is the logical premise of ECC. The main root of current ecological crisis is in the metaphysics of industrial civilization. In PSS, there are systemhood properties obviously in metaphysical ideas of ecological civilization.

Firstly, the system involved subject and object is a self-organizing control system and the system has its own law of evolution. This system is a living organic whole with integrity, nonlinear and dynamic of cycle (Yu, 2010, p.2). "Gaia hypothesis" gives us inspiration that nature will not allow human to change it recklessly. Once human's behavior goes beyond nature's carrying capacity, she may abandon them to survive.

Secondly, as the subject of ECC, human control and manage it in and above the system. In the traditional ECC, human is the subject, and nature outside human is the object. The idea of subject-object dichotomy is distinctly unreasonable; meanwhile, it is the main root of the debate between anthropocentrism and non-anthropocentrism. Human beings have characteristics of immanence and transcendence.

Thirdly, in the PSS, the object of ECC is no longer a natural system, but an "open complex giant system (OCGS)" involving humans. Concepts of "complex ecosystem" (Ma, 1984) and "OCGS" (Qian, 1990) are important metaphysical basis of ECC. To resolve problems of OCGS requires methodology of open systems science (Tokoro, 2010). It is advantageous to explore the inherent logic that the object of ECC converts from nature system to complex system.

4. The scientific theory basis of EEC

The studies on ecological civilization in PSS make the science theories, including systems science, ecology, and management science etc., shift from absence in traditional scientific dimension to presence in PSS dimension.

In the aspect of theory, ecology and systems science provide theoretical basis for controlling and managing system. Studies on ecosystem health and services have made great progress, which will provide necessary theory support for research on “complex ecosystem” in ecology. Systems science reveals inherent laws of system’s being and becoming from internal structure and system dynamics angles, accordingly promoting ECC. **In the aspect of practice, systems science and management can provide methodological support for ECC in controlling and managing system.** Systems science’s advantage lies in dealing with complex system (Flood & Carson, 1993). The object of ECC is the complex ecosystem including human beings with great complexity. Systems science can deal with many problems in it. Many methodologies from management science, such as system dynamics, soft systems methodology, and critical systems practice etc. (Jackson, 2003)' will accelerate the pace of ECC directly.

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How external memory banks (hence "culture") make humans fragile: or on knowledge as enemy of intelligence

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Abstract: External memory banks (EMBs) as main feature of human culture of the Modern Western type can be an advantage of fitness under controlled and stable conditions but become a source of non-linear fragility under conditions of high volatility. This tendency is made worse by the EMB becoming an almost autonomous emergent global system as indicated by the internet and global financial markets. The escalating negative effects of extreme dependence of local social systems on global EMBs can only be stopped and reversed by a controlled reduction and re-definition of the function of EMDs giving intelligence and competence priority over codified knowledge.

Keywords: fragility, memory bank, culture, social systems, volatility, homo sapiens, Darwinism, Lamarckism, globalisation, internet, financial crisis, intelligence, knowledge, knowledge society

Preliminary Remark

My paper will have a slightly Rousseauean or Nietzschean ring to it, but also with reference to Schumpeters creative destruction, Polyani's appreciation of implicit knowledge and Bourdieu's advocacy of “practical sense”. It will seek to formulate a daring thesis in a slightly provocative way to make it a suitable subject for further debate. This does not mean that I, personally and as a philosopher of both politics and science, am not full heartedly favour this thesis; this means only that I do not seek to pave a middle ground or gain a higher ground. A more general position might rather open up in between several extreme or moderate positions.

1 General thesis: A lack of active forgetting makes over-integrated social systems increasingly and irreversibly fragile under conditions of high volatility

We are being faced today with the rapid emergence of an anonymous global system of highly integrated sub-systems of communication, media, technology, commerce, financial services and traffic. This global web of a specific type of activity that is in no way under the control of territorial governments or populations marks a new emergent level of the autonomy of externalized data and memory banks that are a typical trait of human populations in the form of images, monuments, codes, systems of writing and administration, media, archives, traffic systems and machine-based communication.
I call this over-all system that usually is being subsumed under the concept of “culture” the externalized memory-bank for reasons to be elaborated below.
In the following I will call the relatively autonomous system of the externalized memory banks (hence language, scripture, archives, monuments, media, administration of financial flows (credit and debts), technical systems of traffic, storage and communication) an EMB (externalized memory bank).
My general thesis is this: under conditions of relative stability and high control of a local or territorial population or its government over environment and other antagonistic social systems of a similar type (hence classical human history) the cultivation of an ever growing EMB can prove to be a benefit. Yet if the relations of system and environment or system and system reach a certain height of volatility (that also increases in non-linear ways), and if feedback loops of the autonomous dynamic of the EMB and the internal conflicts of sub-systems plus major changes in the environment due to those dynamic are being fed back into this chaotic situation, the EMB will prove to be an extreme disadvantage.
Furthermore I will argue that we are right now entering such a situation that can in no way be re-calibrated to match the conditions of classical human history. Therefore any further delay in abandoning, de-centralising, de-codifying and re-inventing the very function of EMBs as we know them will lead to emergent (non-linear) effects of extreme social and ecological costs. Or, in short: total disaster.

1.1 Definition of societies with externalized memory banks and its specification to the (relatively) Modern Western type of homo sapiens

Following authors such as Varela/Maturana, Latour, Haraway I prefer to give general definitions of systemic types of societies in a biological, not anthropocentric manner. This proves to be of great advantage for the question of EMBs. “Animal”, hence non-homo-sapiens-societies can be described as populations with no or very limited EMBs. Language and tool use tend to be intrinsically connected to the organism. Animals do return to places of habit and re-use the abandoned structures of both their own ancestors and other species, but they do not fixate those cultivations of a site specific memory of uses and habits in monuments and stable codes. The advantage of this very low key use of EMB in non-humans will be elaborated with Darwinian arguments below.

Humans can be defined by their use of EMB that is closely connected to human use of tools, sense of abstraction, use of linguistic codes (of both the phonetic and graphic type) and specific neurological ability of conceiving, selecting and organizing spatial and temporal structures (the “manager brain” of the prefrontal lobes).

As long as human society evolved in such a way that genetic evolution and the relatively autonomous EMBs were in a meta-stable equilibrium one can by and large claim that EMBs were an advantage of fitness: but with the EMB becoming an autonomous, highly integrated and global system beyond the control of any legal or political unit representing a biological population one can claim that it proves to be a grave disadvantage for both the fitness of the species and its relation to the non-human environment.

2 Fragility of memory-bank-dependent societies under conditions of emergent volatility

This situation gets worse with increasing volatility that is both an emergent development with different environmental and social causes of long-term and short-term range and the very effect of the autonomy of the global EMB itself; as can be studied with the recent financial crisis in which a global financial system proved to be autonomous and external enough to strike national economies in relative independence of their internal health with increasing fragility.

In my considerations on fragility and emergent volatility I rely on Nassim Nicholas Taleb's work on the “Black Swan” (hence the non-linear effects of highly improbable events) and “Anti-fragility” as re-calibration of fragile systems to make them not only robust (meta-stable survival under volatility) but able to gain from volatility. A social system that is in its reproduction dependent on a EMB that is of a higher emergent order then this social system itself – a local system depending on a global EMB – will not be able to become anti-fragile for the very dependence on the EMB makes it irreversibly fragile; with non-linear, hence exponentially growing effects. Therefore the relative independence of a local social system from any higher order EMB is the necessary pre-condition for improving its anti-fragile fitness under conditions of emergent volatility.

2.1 Supporting Arguments with a Background in Evolution Theory

The question of EMBs obviously plays into the still valid discussion of Darwinin and Lamarckian concepts of evolution. Whereas the “Lamarckian” position tends to favour the advantage of fixated hereditary traits that have been acquired through the experience of single organisms the Darwinian position opts for growing population rates being the only criterion and proof for better fitness.

The advantage of each position is clear: in a rather stable environment hereditary traits from single-organism-experience mean faster and progressive learning; in unstable environments Darwinian evolution is of far higher advantage: organism stay relatively free and open with each generation to go trough trail and error with only the next or an even more remote round deciding what proved to be useful. Lamarckian evolution is in danger to lead to a fixation of traits that will have lost its functionality under altered conditions.

To sum up: Lamarckian evolution means fast learning, Darwinian evolution means a high rate of optionality.

As biological evolution is usually rather prone to high volatility due to the complex dynamics between systems and system and environment Darwinian evolution will by and large win over Lamarckian.

Yet homo sapiens is a specific type of biological society, an extreme case of “niche construction” as it found a way to create a specific double system of enforced autonomy and stability of its own human environment and the entertainment of EMBs. An EMB is an external Lamarckian storage system: it learns, accumulates and stores in a linear timeline without or with little natural selection and the death and oblivion of each generation that comes with it. To make the EMB a lasting advantage of fitness though homo sapiens has to fixate his natural environment far beyond the degree of biological volatility. And he did so with the help of the very EMB that needed a stable environment to be of advantage.

With EMB becoming increasingly global and autonomous it also undergoes even less of a natural selection. This problem is intertwined with the even graver problem that the artificial stability of the human environment is by now destroying the biological environment of all non-human societies in an emergent volatility.

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Signal, code-duality and information: information as the bridge between two cultures

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Abstract: The problem of two cultures is a deep challenge for global culture. Its philosophical essence is the gap between causality and normativity. In order to get away from this dilemma, a bridge between causality and normativity must be found instead of reducing normativity to causality or vice versa. Information can be seen as the bridge between causality and normativity since it crosses both realms. Secrete of information that containing causal and normative process is its feature of code-duality. Information has two ways to represent: analog and digital code. Analog code is a causal process because it can happen without any anticipation introduced in it. Digital code is a normative process since the coding rules of it are conventional. Information dynamics and signaling game theory can reveal dynamic aspect of code-duality.

Keywords: two cultures; code-duality; information; constraint; signaling game

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1 Two Cultures and Its Philosophical Essence

1.1 The Philosophical Essence of Two Cultures

We live in a globalized age where all human beings are intimately connected as in a small earth village due to high advanced information and communication technologies. Ironically, although technologies help us go beyond the physical, geographical gap of the world our world is split at a deeper level since the beginning of modern time. The world was divided into material and spiritual part by Descartes. Causal process plays a leading role in material world while normative processes rule the interactions of human consciousness. This is the essence of problem of two cultures we all human beings face today (Snow, C. 1959, 1990); a meta-problem threaten to become a global culture crisis. Based on the technological success of the natural sciences, our society tends to abandon humanities to embrace worldviews based on information science. Our social existence as a normative being is aliened to a materialistic world causing serious spiritual crisis as our life worlds has been forgotten The consequences of this is that the quality of the world has been reduced into quantity as Husserl said eighty years ago (Husserl, E, 1936). Normative aspect of human being has come to be viewed as the epiphenomena of causal process. The problem of two cultures has been reformulated as the gap between causality and normativity. As our disciplines has been separated into natural science which handles the problem of causality and humanities which deals with problem of normativity.

1.2 Information can Bridge Causality and Normativity

However, if we want to get a unified image of the world, we should admit that causality and normativity both are necessary part of the world including human society. So, how to bridge the gap between causality and normativity? This is a deep challenge we face in our globalized culture today. Information which includes both causality and normativity can bridge this gap without appealing to new dualism. In this globalized and information age, we should realize that our society is not reduced into a pure materialistic world. Because of information, two cultures are always connected with each other.

2 Signal

Information as the flow crossing both causal and normative realm may bridge this gap. According to Wiener, information is information, not matter nor energy. But it is embodied in matter and transmitted by energy. At one hand, information is normative in the capacity of its making a difference to the consumer's life world; at the other hand, it is causal because it is transmitted by signals which are physical. In other words, information is the process that the information producer sends normative content to consumers through causal process. Only the states that can make a difference to the consumer can be the content of information. That is to say, information process is a selective process in which value has to been involved. How can information do it?

3 Code-Duality

The effect is rooted in the code-duality feature of information. Code-duality of information means that a system has ability to represent the state of world affair in two codes: analog and digital code (Hoffmeyer, J; Emmeche, C. 1991; Hoffmeyer, 1995, 43-45). Analog coding is the process of continuous representation of changes at the source while digital code is discrete representation. Analog code is a causal process while digital code is constrained by normative rules. In analog coding process, there is no anticipation in. As I define causal process as a spontaneous process without anticipation, analog coding process is causal process. Digital coding process is normative process because the coding rules it follows always work for certain purpose. We can say in another way that analog code follows causal constraints while digital code ruled by normative constraints. Analog code is the instrument for action to behave since when handling the world, our action should follow causal laws. When in social communication digital code is encoded by conventional rules, it can be the tool for existential thinking and making of behavioral choices. Analog and digital code is not a kind of new dualism, they are interdepended and both are necessary for information process. Analog code is the vehicle of digital code, without analog code, digital code cannot be manifested; digital code adds conventional or normative constraint on analog code so that it can be applied to reach consumer's purpose.

4 The Flow of Constraint: Dynamic Foundation of Analog Code

Then the signal is sent to a receiver/consumer who? is also an open system. The receiver/consumer decodes the intended constraint from signal and employs it for his own purpose. This whole progress is a causal process. How could normative contend then be added into this causal process? Or how could digital code be transmitted through analog code? Constraint is "the property of being structurally or dynamically organized with respect to (or by virtue of) attributes present (also potential or projected) in some extrinsic object or process" (Deacon, T. 2007). Information processes are processes happening between two open systems. When an open system goes toward an unspontaneous state, an intervention from another open system must happen. The intervention changes spontaneous state of the elements that compose the system, that is to say, this intervention add constraint on elements. So we can say that the constraint of an open system is transmitted to the other open system. What analog code do is this kind of function. So, the function of analog code is transforming the constraint of one system to the other. . The targeted constraint is transmitted or replicated into a signal (or sign?).

5 Signaling Game: Origin of Digital Code

Digital code is a discrete representation of certain state of world affair, which differs from analog code in that it can replicate constraint from information source. Digital code is organized by certain conventional rules in order for the Receiver/consumer to attain some purpose. Conventional rules work for consumer's purpose. In this sense, conventional rule is normative since its aim is to reach certain purpose. I also call it normative constraint of information. Normative constraint is produced in signaling games. (Lewis, D. 1969; Skyrms, B. 2009) As I argued above, a sign always represents certain state of world affair. In sign games, a sign represents whichever state of world affair is contingent. In other words, the relation between signal and state of world affair is unstable. When consumer receives a signal, what content he can read from it is also contingent. This contingent relation can be stabilized in dynamic process of signaling game. The relation between a signal and a state of world affair and whether consumer reads content of message correctly are both determined by payoff. If payoff for producer and consumer is maximized, or at least satisfied, and stable, then the relation between signal and state of world affair can be stabilized. That is to say, normative constraint is added on signal now.

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Crossroads of civilization from a synergetic point of view

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Synergetic methods in the function of tools for investigating modern civilisation as a complex nonlinear self-organizing system reveal the opportunity to regard its crossroads as special (bifurcation) points. The base of philosophical foundations for applying such methods lies in developing the heritage of classical philosophy, Hegelian dialectics in particular, and providing a realistic reinterpretation in the new synergetic context. This means that we can comprehend the new possibilities discovered in critical (bifurcation) points as emergence of new real necessities containing chances, which are eventually chosen or realised by human efforts. So, we can try to investigate a number of possible or credible scenarios of the future development in different areas of human activity, including technological, economical, political, and cultural systems. Influence of the latter type of systems could be understood in synergetic ways as the control parameters governing the processes of social self-organization. Hence, personal efficiency and personal social responsibility can define a vector of such self-organization. Thus, the response of systems studies to the crisis of civilization and its manifestation in culture can examine possible optional ways of development, while their responsibility can be seen in evaluating those scenarios based on their desirability, with outlining the circumstances for the realization of the most optimal way, in particular, in setting up appropriate educational strategies.

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Strategic management and the culture's self-organization potential in the conditions of civilization transformations

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Abstract: Their investigation is carried out with taking into account the self-organization theory principles. The intersubjective interaction directed to cooperation is the cultural policy sense core in the instability conditions. Supporting creative ideas, innovation social solutions, cultural projects and programs containing concrete values and senses the government fortifies civilizational-cultural identity.

Keywords: Self-organization, Cultural Policy, Sociocultural Problems, Dynamic Changes, Civilization-cultural Identity

Sociocultural problems define the XXI century image. Their investigation is carried out with taking into account the self-organization theory principles. First of all it's explained by the fact that the postnonclassical approach applicable to social management is based on the ideas of nonlinearity and development polyvariance.

The process of contemporary sociocultural environment formation is connected with the new subjects' communication system search. The intersubjective interaction directed to cooperation is the cultural policy sense core in the instability conditions. Besides the government role as coordinating subject providing the conditions for the culture's self-development becomes more significant.

Due to contemporary management methods in the system the ability for creation and innovations is kept as well as the raising of freedom degrees for the compound poly integrity reinforcement is going on. Issues about the actual and perspective cultural policy priorities determination should not be considered without social interests. Therefore, basic problems include the concordance of interests among cultural policy subjects and appraisal of their influence abilities onto social development.

In the field of the cultural strategies choice and the "bifurcation point" definition it's necessary to correlate two general tendencies:

- the complication and differentiation of culture as a sphere for a person's self-actualization;
- the overcoming of disproportions, growing "gap" among modern innovations, cultural vectors and spiritual and moral demands in different social groups.

To sum up the concordance of individuals' and social groups' interests with national purposes is one of the most important trands of governmental cultural policy. This strategy can lead to institutional transformations and metalanguage forming, elaboration and application of new cultural policy model absorbing alternative opinions on the culture and its significance in the social development. The contemporary Russian culture image dynamically changes under the influence of renovated cultural environment. Supporting creative ideas, innovation social solutions, cultural projects and programs containing concrete values and senses the government fortifies civilizational-cultural identity.

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Multidimensional thinking as way of exploring complexity: civilization challenge

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Abstract: introduction of the idea about multidimensional thinking and its main concepts and methods. Multidimensional thinking is analyzed within thoughts about complex thinking developed by E. Morin and G. Deleuze. Multidimensional thinking is viewed as an efficient way of exploring complexity.

Keywords: complexity, multidimensional thinking, complex thinking, practice of multidimensional thinking, focused semantic space

From the beginning of the 20th century, complexity in all varieties of its manifestations has become an increasingly attractive research topic. For example, nowadays there are special centers – French Association of Complex Thinking, headed by E. Morin (Association pour la pensée complexe) and German Society on Research of Difficult Systems and Nonlinear Dynamics (Deutsche Gesellschaft für Komplexe Systeme und Nichtlineare Dynamik) – that are developing methods of interdisciplinary analysis to study complexity. In addition, there are the Santa Fe Institute of multidisciplinary studies and the Centre d'Études Transdisciplinaires (Sociologie, Anthropologie, Histoire, CETSAH) at the National Center for Scientific Research (CNRS) in Paris that are also involved in this field.

The problem of *difficult thinking* or *"thinking in complexity*" (K. Mainzer) takes a special place among numerous problems that manifest themselves in the process of exploring complexity. Ideas about complexity emerge and differentiate due to the perfection of people's powers of apprehension. The developing thinking facilitates the discovery of a new level of complexity. For that very reason, researches of complexity should accompany the corresponding apprehension of new opportunities of thinking.

In 2013 Ukraine published a book "Philosophy of Thought" in which a number of Ukrainian and Russian philosophers reflect on new ways of thinking, which have originated recently. Presented publications deal with *complex thinking* (V.I. Arshinov, E.N. Knyazeva, Ya.I. Svirskiy), *nonlinear thinking* (I.S. Dobronravova, I.V. Yershova-Babenko, and *multidimensional thinking* (L.N. Bogataya, F. V. Lazarev).

First, ideas about *complex thinking* originated in the European tradition and simultaneously have continued to develop in several research perspectives.

E. Morin is working in one of these directions. He is the president of Association of Complex Thinking, i.e. the special organization that focuses on studying new cogitative aspects. According to Morin, complex thinking means *free thinking* capable of overcoming fragmentation and divide, which define modern intellectual environment. Edgar Morin calls for the cultivation of variety along with the corresponding development of thinking capable of encompassing this variety as a single unit. E. Morin set forth principles of complex thinking (Morin, 2011).

A German philosopher K. Mainzer associates development of complex thinking with the actualization of nonlinear thinking, with the development of innovativeness, with the controlled emergence, and with researches of trends in the development of complex systems.

A well-known Chilean neurobiologist F. Varela linked complex thinking with ideas of autopoiesis and enactivism. According to them, an observer or a conscious subject become part of continuously changing environment (evolutionary constructivism).

It is possible to consider separately the development of ideas about complex thinking in connection with the idea of the network organization of complexity (M. Castells).

Creative works of two French thinkers G. Deleuze and F. Guattari directly deal with practice of complex thinking. The consecutive reflection of this aspect of complexity development is an extremely interesting research task.

However, the analysis of existing attempts to explore complex thinking suggests that the majority of relevant studies are *descriptive* in nature. They form a great number of terms describing and defining complex thinking, but they do not consider practical aspects of complex thinking.

In our opinion, the development of ***multidimensional thinking concepts*** is the practical way to explore complexity.

Nowadays there are many definitions of complexity. Perhaps the main features of modern understanding of complexity can be described as the following: complexity is *the* *entirety (holism), existing as the simultaneous manifesting multiplicity in a state of continuous changes*. The fact that a subject observing complexity is located inside this complexity and makes up a whole with it is very important. Due to the subject's involvement (incorporation), *complexity* does remain in a state of continuous change (evolutionary constructivism).

Ideas about multidimensionality allow taking steps to complexity exploration. For the first time, a number of Russian researchers used a term multidimensionality to develop the methodology of social researches (V.L. Altukhov, V.Zh. Kelle, M.Ya. Koval'zon, etc.). For example, economic, political, cultural, and social aspects of development in one or another social system were considered as its various dimensions. Thereby any social system became multidimensional. Unfortunately, these ideas were not practically developed. At the same time (without the use of the multidimensionality term) researchers were developing the interval approach that was forming the methodology for the development of intervals of abstraction (F.V. Lazarev, M.M. Novoselov). These ideas are closely connected with the modern formation of understanding about multidimensionality.

The new stage in development of ideas about multidimensionality began due to the introduction and subsequent analysis of ideas about multidimensional thinking (Bogataya, 2010).

The word *multidimensionality* originates from the term *measure*. Multidimensionality is virtually the simultaneous implementation of a variety of dimensions. The real number of dimensions can change according to cognitive skills of a subject. Thereby, multidimensionality comes across as a way of development of complexity because one of the main characteristics of complexity is the unity of many complexity fragments that differentiate significantly as for their nature. Therefore, they demand for various ways of measurement. Due to multidimensional thinking, there is a possibility to understand (explore) complexity.

In 2010 L. Bogataya published a book "On the Way to Multidimensional Thinking," which contains ideas about multidimensional thinking and defines its main methods.

The updated ideas about *thought, sense, focused semantic space,* and *concept,* became the philosophical basis for multidimensional thinking.

Thought is defined as a *complex formation* developed with the help of terms. The thought is explored in the course of thinking. *Thinking* is the processing, i.e. "digestion" of thought. *Senses* originate and reveal themselves in the course of thinking. Every thought is able to generate a great number of senses.

The ***focused semantic space*** is the specific manifestation of grammar environment. Each focused semantic space is formed with the help of terminological basis, i.e. a set of key terms that form this space. For example, a single scientific publication can be considered the focused semantic space. The key terms in this publication are the terminological basis for the corresponding space. The process of thinking takes place in such semantic spaces. Taking into account this approach, it is the discovery and explication of meanings that emerge in the development of one or another thought.

The terminological manifestation plays a key role in the formation of focused semantic spaces. Any focused semantic space contains both *conventional, traditional, and typical* terms and terms that have again manifested themselves. If we examine focused semantic spaces from the perspective of complex self-organizing systems, we may speak about the existence of a unique terminological emergence that results in the discovery of crucially new terms defining new order parameters. Studying focused semantic spaces, we can examine their coherence and the degree of their homogeneity or heterogeneity. Concepts help to bring order to the focused semantic spaces.

Concept in this approach is regarded as *term*, which corresponds to an open set of senses. The concept serves as a so-called order parameter for some varieties of senses that exist in focused semantic spaces. The study of this concept is originally the study of senses, which correspond to the concept, and the study of their subordination.

Methods of work with senses

To understand clearly different types of work with senses, the developing concept of multidimensional thinking introduced an idea about four methods of sense operation.

Manifestation of sense is the first method. It is associated with the first detection of sense from thought. The terminological construct helps the manifestation of sense become real. The terminological construct is a number of terms that help clarify thought in the first place (see more details on this topic in the monograph (Bogataya, 2010)).

Clarification of sense is the second method. It is an attempt to bind a newly discovered sense with other senses that already exist within the focused semantic space.

Confirmation of sense is the third method. Due to this one, it is possible to state fully the discovered sense with the help of terms that are efficiently operating in the given semantic space. On the one hand, clearly confirmed new sense deforms the preexisting semantic space, but on the other hand, it facilitates its development.

Use of sense is the fourth method, which is related to the free flow of manifested, understood, and confirmed senses from one focused space to another. For example, if someone wants to use the idea of *multidimensional thinking* in his or her arguments, it will be a simple example of terminological diffusion and, partly, diffusion of senses.

From the above mentioned it is understood that any interdisciplinary studies can be viewed as a practical attempt to develop various focused semantic spaces simultaneously.Complex disciplinary fields are reduced to focused semantic spaces. In their turn, these fields can be represented by a number of individual focused spaces.

On the one hand, the work with focused semantic spaces is implemented due to practice of *understanding* that was traditionally developed in philosophy and cognitive science. On the other hand, the work with focused semantic spaces allows their unique implementation of *measurement*. For that very reason, the view of the *multidimensional thinking* – thinking that simultaneously performs multiple measurements – is actualized.

It is possible to confirm the following cognitive chain: *thinking – measurement – understanding*. In addition, *measurement* is conceived as the correlation, i.e. the binding of newly detected senses with senses that were detected earlier.

Figuratively, multidimensional thinking can be described as three methods that are implemented at the same time.

The *first method* is associated with the development of specific focused semantic spaces.

The *second method* is the simultaneous actualization of a number of explored focused semantic spaces. It is important to emphasize that many of these spaces are actualized spontaneously, as if surfacing from memory.

Finally, the third method. Virtually the act of multidimensional thinking is carried out for the sake of it. It is the emergence of a new thought that manifests itself as a result of a sudden, rational unpredicted integration, i.e. collision of sufficiently different semantic spaces (individual senses). Spontaneity of space integrations allows us to assume that multidimensional thinking is the manifestation of *bounded rationality*.

It is important to emphasize that a thought emerging during the multidimensional mental activity is developed in the very specific focused semantic space. Thereby, the multidimensionality that is used for the stimulation of processes of thought formation collapses to one-dimensionality, i.e. to one focused space.

Finally, to sum up we can conclude the following. ***Multidimensional thinking*** – is a set of specific cognitive methods aimed at the organization of thinking about *complexity*. For that very reason, *multidimensional thinking* can be considered the manifestation of *complex thinking*. Due to the development of ideas about multidimensional thinking, there is a way to develop many problems of complexity – plurality, instability, innovativeness, and a number of other problems. Multidimensional thinking does not exclude traditional formal thinking but supplements it, allowing comprehension of some modes of manifestation of complexity at the same time.

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Communicative strategies of cognition for complexity

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Abstract: Major problems of organization and implementation of the research projects aimed at the holistic way of the reality construction, exploring complex systems, have the communicative nature. The study of the communication strategies involves exploring various forms and methods of scientific communication used by scientists for problem statement, during the research process and the results presentation.

Keywords: communicative strategies, complexity, visual communication, transdisciplinary projects.

Development of modern world is characterized by growth of diversity, dynamism and uncertainty of occurring changes. Increase of object scale and complexity in social, economic, technical, ecological and other areas begets the need of defining the possible ways of their development, without which the effective management of mentioned objects is impossible. Therefore the next stadial type of theorizing discourse, a projective one, is appearing. The creative competence of theorizing discourse is based on the innovativeness of scientific language of present statement.

Each theory reveals the innovative concept or concept configuration in its basis. Appearing as a phenomenon of internal discourse which semantic units are meanings, not values, concept has a pre-predicative obviousness and works as interpersonal communication. An example of projective theorizing discourse could be an interdisciplinary research project as the organized form of different disciplines interaction for understanding, justification and management of the phenomenon of supercomplex systems which are of high heuristic importance. Main problems of organization and implementation of transdisciplinary projects has the communicative character as it is a new holistic way of structuring the reality with domination of language polymorphism and analogy.

The theorizing consciousness demands polylogues, an ability to think in different logics. The appearing through polylogues ability of moving to another position according to previously studied facts, an ability to transfer another's point of view into self experience, are provided by communicative resource of solidarity of unique human consciousness. Communication appears when one human consciousness influences another human consciousness with the following transfer of experience.

While entering the scientific area and creative involving of scientific communicative system, a researcher forms own communicative strategies due to appearing needs and possibilities. They are subordinated by the logic of research and correlated with the aims and evaluation of researcher's position in social and cognitive areas of discipline. The researcher selects forms and channels of communication overcoming the borders of disciplinary community and using the possible resources of influence. The public and the virtual communications appear at this stage. Each of them could be interpersonal, group or mass. The features of virtual communication are set by the channel of communication which is based on information and communication technologies. Communication is mostly set by the channel it is realized through. Due to this point, the verbal and visual channels are especially interesting as the objects of research. Modern society in particular did non drop down the interest in rituals because of their high efficiency which is being studied in the Theory of Performances. All this features might be seen as external. By the way, communication is influenced by internal factors, types of communication like mythological and art communications.

From one point, the visual communication is the result of long-term messages. From other point, visual communication does not have the same level of codification and the message is often created by involving the grammar. Visual communication is not so polysemantic as verbal communication. Visual one is followed by stronger control but allows to send its message through time.

Verbal communication is crucial in any area of human activity. Verbal communication does not mean just text communication, as text is considered nowadays as a unit of both verbal and non-verbal areas.

When verbal communication uses the verbal channel for transfer, visual communication uses visual cannel, a performance disposes its message in space in certain point of time.

While rationalizing our communication it is important to remember that symbols and myths form the frame of world we live in. Images, symbols and myths form cultural and social worlds, set the bounds of cultural and ideologically acceptable in our society. Myth is one of hidden phenomena.

Modern civilization has certain kinds of myth-making mechanisms. The first (and the most crucial) are mass-media (in the aspect of printed sign), television and cinema (in the aspect of visual sign). They are followed by literature, theatre and other arts. Last group creates art worlds. We analyze the reality due to actual cognitive structures we have. Subsisting on previous experience we are able to understand new situations. Visual images are very important for this process. Mythological structuring of reality sets meaningfulness of this reality.

M. McLuhan considers television as a means, which involves four senses at once. According to him, it is more suitable for transferring of something which is going on, than for previously preset monosemantic messages. Communication is realized through all possible channels, so it does not allow to avoid being out of informational space. Public relations specialists pay much attention to television reports to avoid misunderstanding of certain messages in it by audience.

Novelty of Internet as a type of mass-media is in combination of interactivity with such new features as unlimited content and global character of communication.

According to projective strategy the theorizing statement is a peculiar evolving sample, which is to survive in intersubjective environment of human thinking. The language of everyday communication, symbolical and conceptual systems of art and science, forms of visual representation and symbolic of spiritual culture form the complex and diverse layer of grammatical and semantic structure. Scientific communication is a vociferous dialogue, it reveals communicative strategies which are preset by positions and dispositions of cooperation participants in social area of science. Within interdisciplinary research project, the growth of amounts and diversity of forms of presented information bring forth certain problems. These problems are related to the need of creating conditions for effective and ergonomic perception, processing and transferring of information, knowledge, ideas and orders in different forms – explicit/implicit, statistical/dynamical, verbal/visual. Visual communication provides the transfer of ideas and certain information through visual images, including signs, symbols, text (of different format) and elements of graphic design, pictures and multimedia illustrations.

A cognitive basis of visual communication is an ability not only to convey the information to the client in the most effective way, but also to provide its procession by stimulating the activity of both brain’s hemispheres. Nowadays the visual representation of information, data and knowledge through illustrations and graphics seems to be effective, suitable and expressive for most sources of information. This happens because more and more people tend to perceive visual images – pictures, schemes, collages, music videos, and (but much less) text. An image is one of communication means which is crucial for idea presentation. For example, infographics has multilayered nature and flexible cognitive structure, it transforms the consumer into co-author of new information.

Thereby, communicative strategies are developed due to content rules, resources and sequence of communicating actions of communicant. As a result, the understanding of supercomplex systems is closely related to communication strategies, which aim is not only to report something, but also to change something. This change comes into cognitive and social areas of science and so – into conditions of further communication. Every element of cognitive act and its content is permeated and surrounded by the context of communicative interaction.

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Ukraine on a civilization crossroad: a synergetic view

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Abstract: The report attempts to formulate an understanding of the current situation in Ukraine based on the synergetic . methodology.

Keywords: self-organization, synergetic, attractors, chaos, complexity

Initially, the theme of our symposium "Crossroads of civilization from the synergetic point of view" was formulated by its organizers rather as a response to a range of general issues for discussion than a reaction to the situation in Ukraine. At that moment, Ukraine was progressing towards signing of the agreement on an association with European Union, and there were high hopes for democratic changes in the country.

After these hopes were abruptly destroyed, and our government reversed its declared move in the European direction to its usual obedience to the Russian authoritarianism, a protest movement began in the country. This movement was mostly spontaneous, especially after police gave a cruel and unprovoked beating to protesting on the night of November 30th.

From the synergetic point of view, it would be natural to describe the protest movement in Ukraine as a process of self-organization. Among forms of social self–organization, the Ukrainian sociologist Lubov Bevzenko (Bevzenko 2002) mentions the following - an exited crowd, a myth, and a game. It can be understood on the reason for the basis of self-organization – nonlinearity – is human feelings. In this case, these are the feelings of Ukrainians' disappointed hopes for European direction as a way toward political freedom and the value of human dignity. Cruel actions by police demonstrated that state power ignored these values. Tens and hundreds of thousands of disgruntled people came to Kyiv's main square, the Square of Independence (in Ukrainian, central square is *Maidan* [maj'dʌn]). This coherent cooperative movement as a form of self-organization is not a crowd but the realization of a myth. It was and remains the myth of freedom and justice.

However, the self-organization of Maidan should not be confused with political self-organization in Ukraine in general. It is necessary to note that the medium of political self-organization in Ukraine is, like any other nonlinear self-organizing medium, fundamentally chaotic. Initially, after the abolition of one party system during the first post-soviet stage of Ukraine's development as independent country, this medium of self-organization was the homogeneous medium of statistical chaos. Then many political parties were founded which had two main expressed attractors of movement: the democratic and communist ones.

In the case of self-organization in a homogeneous medium, the dynamic stability of a self-organized system can be provided by a "victory" of one attractor over the other. But if the other attractor is not destroyed, a return to it (the so-called "fold") remains always possible. Unfortunately, the prohibition of the Communist party was eventually lifted, and the danger of a return to the communist order or, at least, a virtual possibility of it remained to exist. It was by exploiting this danger that Russia's Yeltsin and Ukraine's Kuchma managed to get re-elected for their second terms.

The next stage of political self-organization in Ukraine took place in a medium formed by political parties and public organizations, that is, in a medium, where certain parameters of order existed. According to one synergetic interpretation of mathematically analyzed results of several Ukrainian parliamentary and presidential elections (Dobronravova, Finkel 2006), this medium acquired the features of dynamic chaos. The formation of possible steady structures in dynamic chaos is made possible by competition of attractors. Such structures are called fractals, which are fundamentally complex entities possessing scale invariance. In the case of prevalence of one of the attractors in this competition, stability is disrupted, and the "blow-up regime" occurs.

During the 2004 "Orange revolution" in Ukraine, the thrust of people's protests was aimed at stopping falsification of the presidential elections results. The resulted political crisis was resolved by conducting an additional round of fair presidential elections. At the time, I made a special appeal on the radio calling for preserving the balance of powers in Ukraine in order to sustain its integrity as a unity of various populations inhabiting its different areas that historically belonged to different empires or, to use Samuel P. Huntington's formulation (Hantington, 1996), to different civilizations (the Russian and the European ones). This balance of powers made possible by fair competition of the attractors was what provided the existence of a dynamically steady political structure.

Victor Yanukobich's small-edge victory during the relatively fair 2010 presidential elections did not result in mass protests not only because of people's disappointment in the political in-fighting within the democratic political structures deeply stuck in inner disagreements between Yushchenko and Tymoshenko. Political technologies that facilitated the victory of Yanukovych were mainly based at the time not so much on electoral falsifications (which did take place, especially in east regions), as on the opposition's failure to unite.

The common argument about the specificity of Ukrainian political self-organization until recently has been that it is related to the action of external attractors: Russia and Europe. It would seem that the present political conflict in Ukraine has the same nature as the current Maidan is called EuroMaidan. The same influences and the same areas with prevalence of one or another force look almost the same, too. However, an analysis of philosophical foundations for understanding the formation of efficient causes in the current process of Ukraine's self-organization may provide an alternative point of view.

The emergence of efficient causes of self-organization is determined both by its basis and conditions (Dobronravova 1997). Non-linearity as the basis for formation of efficient causes of self-organization in the context of bifurcation in the Ukrainian society is generated by the mass attitudes of the people who are dissatisfied by the despotism of the authorities, total corruption and the dishonesty of judges. From the perspective of the majority of Ukrainians, the complete inability of ruling party leaders to provide fair competition is directly connected to the criminal origin of their capitals as well as to their mob mentality. Consequently, this situation coupled with decreased inflow of investments to the country resulted not only in a political but also in economic crisis aggravated by the politics of Russia trying to subvert Ukraine's European integration. Therefore, the external influence by Russia and Europe create the conditions for forming the efficient causes at each point of the chaotic nonlinear dynamic of Ukrainian political crisis. Each point in this non-linear dynamic is a point of bifurcation, a point of choice by chance-based variants of further events. Even though the external influences can determine the choice of the one or another version of events, the set of variants itself depends on the internal situation in the Ukrainian medium of political self-organization. The specific attractors in this medium depend on cultural and ideological expressions of Ukrainian people' imagination, which act as the control parameters of self-organization. Therefore, information and propaganda in the context of competition of historically originated human myths and values are constantly changing the medium of self-organization and serving as the basis for new variants of attractors.

In this way, the popular protest, which was initially originated by a reversal from the European vector of development, quickly outgrew its origin by directing itself toward renewal of justice and abandonment of criminal methods of conducting business and administration of the state. Therefore, contrasting the Ukrainian West and East and attempting to reduce the situation to an opposition between the Russian and Western vectors of development actually obscures the real situation in Ukraine. The evidence of this is the presence of people from many different regions of Ukraine on Maidan in Kyiv as well as spreading of the Maidan movement to practically all of Ukraine (the long years of terror by the local criminal power in Donetsk and Luhansk complicate the actions of pro-European activists but they cannot destroy neither their presence nor the sympathy toward them by many people there).

A civilization crossroad does exist in Ukraine, but it is not the clash between the Western and Orthodox civilizations. The question is more about the moral choice and aspiration to uphold fairness and justice in society. These values come forward as regulative ideas for the people protesting on Maidans, securing for them not only national but also international support. For this reason, the Russian authoritarianism sees in Maidan a great danger for itself. Similarly, it is its empire-styled politics rather than the Orthodox values that characterizes the role of Russia in today's Ukrainian conflict. The victory of democracy in Ukraine will give to the Russian people the hope of reverting from Putin's orientation toward the old empire attractor to the democratic vector of development that originated in 1991. The question is actually about the terms of destroying the post totalitarian ways in Russia and Ukraine and the ability of authoritarian leaders to sustain themselves economically. The difference between the Russian and Ukrainian peoples historically has depended on the difference in their reliance on their state powers and, respectively, on their readiness to tolerate its oppression.

In this regard, special attention should be paid to the capacity of the Ukrainian people for self-organization. The centuries-long experience of Ukrainians living in the conditions of the absence of their own state generated different forms of local self-organization. Among them, the military democracy of Cossack's Zaporizzyga Sich (not incidentally, the Maidan is often compared precisely to this form of (currently non-military) self-organization. It is the Ukrainian peasants' ability to reproduce traditional forms of public life in villages and farms repeatedly moving around the fertile steppes of Ukraine, to rescue themselves from the raids of Tatars, and later from the attempts of enslavement by Polish or Russian squires. The history of people contained in its songs, the experience of past battles contained in its dances (such as battle hopak) - these Ukrainian cultural traditions worked as governing (control) parameters of self-organization.

They are present both in the mentality of Ukrainians and in their collective unconscious. These traditions are based on their solidarity and individualism; on their aspirations to independence and their ability to adapt to life's changing circumstances. One can add here Ukrainians' utter lack of reverence toward the authorities, while this reverence is an essential factor for the patriarchal attitudes practiced in post totalitarian societies. Many of those who currently blame Maidan are still the slaves of such attitudes.

Therefore, uncompromised struggle and strategic actions aimed at victory rather than consensus are directed not towards elimination of one of the attractors in the political self-organization in Ukraine but toward the providing of their competition. The formation and upholding of dynamically stable complex fractal structures are possible in the field of such competition. Such competition is made possible precisely by the communicative action directed at the consensus to which we are encouraged by the European politicians. It is a consensus not between the gangsters and their victims (which is impossible), but between all the conscious people in Ukraine.

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The crisis of systemacy and human-dimensionality: evaluating options for the future

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Abstract: The current crisis of civilization could be exposed as the crisis of systemacy – with different social systems being isolated from each other and failing to recognize values of other systems. The rise of nationalism is an example of partisanship and of what could come out of the current situation and become a threat for the future. To enable the most desirable future options to come true, synergetic and system studies could imply the position of human-dimensionality, with human persons, and not social institutes, being subjects of the recognition of moral values, so all the options could be evaluated on the base of their desirability as to our common non-partisan future.

Keywords: crisis of civilization, values, nonlinear thinking, system crisis, social institute, humanism, human-commensurability, human-dimensionality, post-non-classical science, moral universality.

The contemporary state of the humankind civilization is often considered to be that of a crisis – if not a catastrophe. Uncertainty of the future, deficiency of common ideas, and escalation of the ecological threat to the environment are but several features of the current situation that could be aptly called as bifurcation point when important decisions as for the future development are to be made rather imminently.

What system studies in general and synergetic in particular can invest into the comprehension of the crisis in question? First of all, it is investigation of the nature of that phenomenon. I think that from the methodological point of view, the crisis of civilization could be called not only a systemic crisis, but the crisis of systemacy as well. Its deep roots lie in disconnectedness of different spheres of human activities. Such a view on social systems originates mostly from the conception proposed by Niklas Luhmann who argued that it is quite normal for different systems to function as self-contained entities, each using its own languages, values, and activities (see: Luhmann, 1995). However, as a result of such functioning, systems become isolated from each other – and especially from general values (as, according to Luhmann, values as a 'code' of a system could never be 'translated' into values peculiar to other systems). That implies that, on the one hand, human understanding of the world becomes fractioned and incomplete, being separated into different almost non-coherent fragments; on the other hand, partisanship in values leads to the deprivation of the higher level of values from the horizon of humans engaged in social activity. The latter loss is explained by the fact that social institutes (themselves organized as self-contained systems) prefer pursuing goals that enable the efficient future functioning of those institutes themselves – and not goals and values of higher level of hierarchy that define the greater good of all humankind and not only that of a single institute or a social system (see: Mielkov, 2013).

In fact, such behavior of systems comes into contradiction with the trend of democracy and the evolutional development of human personality, the latter constantly obtaining new forms, ways, and levels of identification – and that's the process, which is incompatible with unification of culture, with imposing one 'correct code' or a value system. That is, partisanship opposes universality, which could be the only base for human activities, including that of scientific knowledge pursuing the goal of the Truth, however complex and dialectical that pursue can actually be. Such social phenomena as feminism, racism, nationalism, chauvinism, Zionism / anti-Semitism and many other similar '-isms' present but artificial cultivation of one and only human identity – and that's why such identity appears as abstract and destructive, even if originally, amongst other alternative identities it actually was natural and organic. Thinking in obsolete binary oppositions, such ideological movements strictly discriminate people of different race, sex, ethnos, and political convictions, not allowing interspersing social discourse with any other human qualities (see: Myelkov & Tolstoukhov, 2009).

That feature of any abstract identity and a self-contained system could be well demonstrated on the example of nationalism that is rather history now in Western countries but still present a threat to social consistency in Eastern Europe. Croatian writer Slavenka Drakulić (who lives in Sweden today) describes how it all was felt in 1990s in the following way:

"Being Croat has become my destiny… I am defined by my nationality, and by it alone... Along with millions of other Croats, I was pinned to the wall of nationhood…. That is what the war is doing to us, reducing us to one dimension: the Nation.

The trouble with this nationhood, however, is that whereas before, I was defined by my education, my job, my ideas, my character – and, yes, my nationality too – now I feel stripped of all that. I am nobody because I am not a person any more. I am one of 4.5 million Croats… I am not in a position to choose any longer. Nor, I think, is anyone else…

…One doesn't have to succumb voluntarily to this ideology of the nation – one is sucked into it. So right now, in the new state of Croatia, no one is allowed not to be a Croat" (Drakulić, 1993, Pp. 50–52).

A very similar process is unfortunately in effect in Ukraine now that has recently even faced violent riots and overthrow of a legitimate government by organized nationalists. While being de jure unitary country, Ukraine is in fact divided into two distinct cultural systems with Western part dominated by rural traditionalists (former Austrian lands of Gallicia and Lodomeria), and Eastern part inhabited by urban and well-educated Russian-speaking population. The 'Maidan' riots here were organized by the Western part that now tries to enforce its archaic and Nazi-like (see: Kriuchkov & Tabachnik, 2008) linear thinking over the whole country, prohibiting public usage of regional languages (other than Ukrainian), hampering Russian-influenced canonical Orthodox Christian church, and even outlawing strictly anti-nationalist parties (like the once great Communist party). The irony is that such an offensive on any plurality and non-linearity of thinking is conducted under the slogans of EU-orientation, European values having nothing to do with wild and rude nationalism…

Of course, that depiction is but a subjective view and other witnesses of recent Ukrainian events could rather praise insurgents – like Iryna Dobronravova, the head of Ukrainian Synergetic society does. However, the problem is not in 'choosing sides', but in the whole situation of systems' isolation – so that values are not shared and not even recognized between different systems! By providing the 'freedom' of ethnic nationality, abstract ideology turns to be a totalitarianism of a kind, "silencing or marginalization of alternative, non-nationalist political languages" (Brubaker, 1996, P.20), – and there is no exit up to higher levels of values, to the ideals common to any social system.

Literally every human community is multiethnic and plural now, and their plurality, as well as proliferation of identities manifested by personalities they consist of, still increases as they follow the course of their cultural and civilization development. Thus, nationalism (let alone Nazism) could not be an adequate solution to the deficiency of social values, and nobody should be forced to confess a single identity, even the one that seems to be the most progressive and fashioned. But how to overcome the seclusion of systems' codes?

I think that it is synergetic in particular and system studies in general that could be used as a precious tool for connecting those isolated systems to each other – first of all, basing on their human moral dimension. Human-dimensionality as a feature of the new Weltanschauung elaborated by present-day post-non-classical science (Stepin, 2005) implies, in my opinion, that only human persons can serve as potent subjects of values – and not social institutes or systems in general.

We need that common values because it is the common future of our civilization, and of our nature as well, that unites all humans in all countries, all cultures and all nations, – Ukrainian philosopher Anatoliy Tolstoukhov named that phenomenon 'Eco-future' (Tolstoukhov, 2003). Studies of future reveal that different option could be evaluated as more or less desirable, so that human activity could and should be directed at fostering the most favorable ones and preventing destructive and inhuman ones from coming true. That's why synergetic could be understood not as a stand-alone field of investigations (that observes 'bifurcation points' from some outer position similar to that of quasi-classical sub specie Dei), but as a ground for connecting practices of different systems and areas of human activity while actually choosing our own future – and not passively allowing any system or institute do that for us. And that could be fruitful and promising – as long as we learn to overcome our systemacy and linearity of our identities while elevating to the higher and more universal levels of values and goals.

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Individual social responsibility as a factor of corporate and personal self-organization

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Abstract: The abstract presents a result of re-thinking of individual social responsibility in the context of the post-non-classical rationality. New opportunities and challenges provided by the post-non-classical methodology for individual social responsibility awareness are evaluated.

Keywords: individual social responsibility, postnonclassical methodology, psychological practices, postnonclassical methodology, rationality types, wholeness, integrity, self-organization

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1 Social responsibility in the postnonclassical context

The phenomenon of social responsibility, individual inter alia, has been an object of philosophical reflexion since olden times as a basic determiner of humans and their practices. In thesaurus of the philosophy of science the concept of individual responsibility was also present, however it was considered rather as an element of "background knowledge" and a baseline quality of the subject. But since complexity, irreversibility and integrity have become characteristic of various subject matters, especially relevant to any dimension of human life, the concept of individual responsibility now appears among key notions influencing our understanding of these areas.

On one hand, based on nonlinearity conception development, man appears again in the center of the whole of nature, assuming new liability for it, according to I. Prigogine and I. Stengers. Herewith, relations between man and nature and between man and man are revised in terms of their essential codependence, coorganization and reciprocal becoming. (Prigogine, Stengers, 1986).

On the other hand, the essential randomness of choice of evolution paths, being an aspect of irreversibility was - and often is - interpreted as a reason to turn off a question of Subject's responsibility both during his activity in the world and his intersubjective encounters. A cultural background for this interpretation is related to the postmodern heritage. We can remember M. Foucault describing *«crossroads of infinity» as "a great uncertainty external to all"* (Foucault, 1972, p. 22) out of any external and internal determination.

With that, on closer inspection a methodology paradox can be seen: a polyvariety of further system adaptability is often considered as a reason to remove subject's moral responsibility notwithstanding a part of the system he constitutes. Since everything is possible on the verge of a phase change, and a specific outcome stoops to no man's lure, what is the difference, which means to reach our microobjectives we chose? Thus – the very notion of integrity turns out to be questionable because of multiple-path scenarios of its development and due to the essential randomness in realization of any of them.

This paradox is related to a vision of opportunity set (affording a choice in "a bifurcation point") as endlessly wide. At the same time the integrity is seen as an effect resulting from this choice.

The above methodology paradox is removed by recognition of the fact that the opportunity set affording a choice in a nonequilibrium state (in authentical synergetics this state relates to the irreversible transition point), is nonetheless limited.

> *«Finite opportunity series is set by the environment considerations where self-organization happens. So there are some definite – but not any – opportunities, determined by attractors endemic at this environment (attractor is a stable regime of activity towards which guidepaths will tend to be drawn in the phase space). Moreover, the choice itself between two or more definite (but not any) opportunities makes it possible to classify the self-organization environment as a whole. This choice appears simultaneously with the order parameter (and right for it). »* (Dobronravova, 2003, p.7)

2 Individual social responsibility

Considering these potencies it is proposed to treat an aspect of individual responsibility – individual social responsibility. Along with corporate social responsibility, the phenomenon of individual social responsibility, being discussed in countries with a developed CSR culture, is in many ways challenging in particular in the context of the postnonclassical approach. First of all, the tradition of individual social responsibility is historically engrained and is a part of Ukrainian mentality. It is attested by private initiatives of mutual aid, widely and spontaneously arising during past and present events of political rebellion, as well as by the development of charity movement emerging on the level of individual extralegal initiatives and private associations. Second, from the perspective of the postnonclassical approach, for quality changes of open nonequilibrium self-organizing systems, among which are both society and individual, environment state should be relevantly ready. From this point of view an enabling environment for CSR is created not only and not so much by pushing the business to act by the presence of pressure actors like the government, institutional investors, NGOs and other “forcing factors”. But rather by all individuals constituting a corporate community, taking into account that such an environment as a whole will exceed the sum of its constitutive elements. Given that behavior of elements is coherent, of course. That is corporate social responsibility, in its functional version, settled not as a result of organization (from top to bottom) – but as a result of self-organization – turns out to be directly related to individual social responsibility – in its potential, virtual or real expression.

For a postnonclassical mind such a dependence of choice on environment considerations is manifest also in psychology. That is why another point of peculiar interest is an influence of individual social responsibility on personality, and specifically on a dynamics of his / her psyche providing the embedding of individual social responsibility in a system of human everyday practices. Treating the psyche as an open supercomplex system, it can be assumed that such a responsibility may be a factor of its deployment and / or of discovery of other points, meanings and vectors of life – id est, it can play a role of self-organization factor. This idea underlies the logotherapy method based on a patient’s awareness and work on research and realization of a meaning in his / her life in any, even the most critical circumstances. Conversely such a work proves successful only by changing the vector from egocentrism to cooperation and empathy, self-transcendency, defamiliarization; towards a stance on external situation and oneself. (Frankl, 2006). If the pure intellect ensured an unprecedented extent of independence both from the environment and the life-preservation instinct, then the intellect related to individual social responsibility ensures codependence, co-reference, noninvasive adaptability of man to the social medium, and larger - to the life environment. In this respect it is pertinent to consider as environment or *medium* both outside and inside environment (internal world) of a human.

It is in this context – individual social responsibility as a capacity to realize and remember the own irremovable implication in other’s needs – that it is proposed to consider it, using the postnonclassical methodology and taking into account all the complexity and reflexivity of the practices involved.

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Psychosynergetical strategies of human activity. Conceptual model “The Whole in the Whole” in the post-non-Classical period

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Keywords: Psychosynergetics, conceptual model “the Whole in the Whole”, open nonlinear self-organizing mediums, psyche-dimensional mediums, Post-non-classics, fortuitousness, non-equilibrium state, system-coordinated behavior, Theory of change.

An important point of the present stage of development of Society and Civilization is aspiration to keeping a Human and Humanity not so much as a biosocial being, but as a symbol of development of intelligence and spirituality with an accent on their psycho- and noo- aspects, i.e. on psycho-bio-social and noo-bio-social in them. At this case both the presence of the bio-carrier (a human body) and the lack of correspondence between noo- and bio- laws, which was obtained by genetics, should be taken into consideration at the given stage. The problem statement, which is adjusted with the named point, was posed already (Kordyum, 2001). From these positions the conceptual-strategic model of human activity may be created and realised in the context and on the basis of Psychosynergetics (Yershova-Babenko, 1992).

The initial plan and an idea of creation of Psychosynergetics as the new scientific area, which would combine Synergetics and Psychology emerged in 1989-1992. It arose as the result of the transdisciplinary search of methodology of research of human psyche as a super-complex object on the basis of Post-nonclassical scientific positions and philosophical-psychological analysis of conceptions of human psyche. The mentioned researches were realised more than 15 years ago due the support from the Philosophy Institute named after G. S. Skovoroda at National Sciences Academy of Ukraine and from the Pedagogical Sciences Academy of Russia. Also, psychological and psychological-pedagogical researches of the mental processes (including experimental ones) were fulfilled in different years in Odessa Polytechnical Institute, Odessa school of air defence, Institute of Russian language named after A. S. Pushkin (Moscow) and in Odessa Medical Institute named after N. I. Pirogov.

Psychosynergetics is a new scientific area (Yershova-Babenko, 1992). The object of research of Psychosynergetics is the range of psyche-dimensional mediums – the open nonlinear self-organizing mediums. Human psyche, its state and structure and ideas of a person (group, society, and civilization) becomes an essential and intrinsic (system-formative, change-generative) factor in formation and existence, development and destruction, in behaviour of mediums of this kind. In its turn, psyche is determined with age of Individual, with the speed of sub-units, which form and arise in the general system, with the different level structures, their relations and boundary conditions. From these positions, the complexity of psychical and mental – of alive, lifeless and virtual – is studied and described (Yershova-Babenko, 1992, 1993, 2005, 2009a, 2009b).

We consider an idea about «the proper value of a Person, the human in a Person» in meaning not so much biological, biosocial or social-informational, but as psychical, mental and spiritual one, as nonlinear integrities, which are non-destructive and becoming. It allows to consider the value of an Act and Event, not simply the value of information, but its meaning at the level of Harmony of relations and behaviour of a Person, group, society, civilization and Universe in terms and from the standpoint of nonlinear thinking culture, nonlinear synthesis and synergism. The mentioned positions express the essence of a Post-non-classical science, the basis of world-outlook and self-understanding in XXI century, the methodology of «Medium in Medium» as «the nonlinear Whole in the nonlinear Whole». The tools of this level of consideration include the concepts of “relation”, “speed”, “age of structure”, “boundary conditions”, “state”, “non-destructive formation” of psychic phenomena, the nonlinear correlations between and inside these phenomena being in vastly non-equilibrium state (Zaporozhan V., Yershova-Babenko I., 2003).

One of essential features of the modern period is important for adequate mentalisation and socialisation of the person. It is the abrupt change of speed parameter of informational mental processes (to put it more precisely, the sense- and value-forming ones), which accompany the change of socio-political, social-economical, cultural, informational and psychological conditions of human life. The notion of «life conditions» also includes the intrapersonal world of a person as the psyche-dimensional medium, which operates with information, meanings and energy in a psychosynergetical mode.

In the context of Psychosynergetics, such character of medium is treated in I. Prigogine's terms as the «vastly non-equilibrium conditions»; at this case the behaviour dynamics of mediums depends on the speed of processes and boundary conditions (Prigogine, Stengers, 1999). In our case, it is the speed of informational and semantic processes, which are generated and occur in the psyche-dimensional medium of the person, in the certain condition of this medium. The extremely non-equilibrium state of individual psyche becomes an organising factor of the personal mental state change in these conditions and the mechanism of occurrence of the qualitative characteristic of Noosphere. The degree of aggression of Informational-Mental-Spiritual-Emotional Medium (IMSEM), its informational (speed) and emotional (anxiety) components may be considered as the second mechanism. Fluctuations, small heterogeneities, defects and other random factors become additional factors.

In experts' opinion, *"... at the modern level of researches it is possible to formulate a number of principles of structures association <and they> may be expressed through requirements of the coordination and synchronisation of paces of development of the parts, which unite into the faster evolving whole"* (Knyazeva, Kurdyumov, 1994, p.23). In the context of Psyhosynergetic concept we come not from the dichotomy "Part-Whole", but from the position «the Whole in the Whole» as «the nonlinear Whole in the nonlinear Whole», from the transdisciplinary point of view. Therefore, agreeing basically with S. Kurdyumov, we consider requirements of the coordination and synchronisation of paces of development to «the Whole in the Whole» level. Being in vastly non-equilibrium state, the dissipative structure can be spontaneously re-formed in a whole.

This step is possible, since I. Prigogine examined this question as applied both to chemical reactions and to society as the human-dimensional medium more than 25 years ago. In the foreword «Science and Change» to I. Prigogine's book «Order from Chaos» O. Toffler uttered an opinion about that I. Prigogine's position might be applied to information. He wrote about this: *"the Brussels school ideas, which are essentially based on Prigogine's works, form the new, universal theory of change. In very simplified form the essence of this theory is reduced to the following. Some parts of the Universe can really operate as mechanisms. The closed systems are those, but at best they make only the small part of the physical universe. The majority of the systems, which are of our interest, are open - they exchange energy or substance* (and information, it would be possible to add) *with an environment. Biological and social systems, undoubtedly, belong to open systems… and it means, that any attempt of understanding them within the framework of mechanistic model is obviously doomed to a failure"* (Prigogine, Stengers, 1986, p.17).

The listed above positions of new understanding of a Person and conditions of his/her environment have led to posing a question about the necessity of another quality of human activity strategies, which should be essentially different from existing one. The level of occurring changes demands the rigging human with adequate skills.

One of the primary positions of our concept is expressed with this notion. Each of mediums acts as forming nonlinear open self-organising psyche-dimensional integrity, i.e. it has a psychical origin. Posing problem in this way demands us also to take into account the following features of the "structure being formed": the kind of this structure, the kind of the general course of events, the natural and social patterns. Each of features can determine the breaking through fortuitousness under corresponding conditions.

The question about which fortuitousness (fluctuation, chaos at a macro-level) and when may succeed in egress, the degree of constructability of this burst, is answered by the I.

Prigogine's Theory of change and H. Haken's Synergetics in the science of Post-non-classical period. Proceeding from the dissipative structure behaviour, I. Prigogine emphasizes, that fortuitousness hitches the remains of the system on to a new way of development. When the way is chosen, the determinism comes into force (Prigogine, Stengers, 1986).

One more position is entered on the conceptual bases of the model and strategy we suggest; the system-coordinated behaviour (the far-ranging forces according to I. Prigogine) provides the Unity: the unity of the intrapsychical world of a Person; the unity of the Person and society created by this Person; the unity of the person, society and the nature, Universe they live in. The author uses transdisciplinary, synergetical and psychosynergetical methods.

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Irina Yershova-Babenko was born in Odessa, Ukraine in 1950. She has graduated from Odessa University (1976), and from Moscow State University (1980). In 1993, Irina has obtained degree of Philosophy Doctor on the speciality "Philosophy and Methodology of Science" with dissertation "The Methodology of Research of Psyche as Synergetic Object". She is an academician of the International Informatization Academy UNN in Moscow since 1996. In 1993 she founded author's school on preparing investigators, which uses author's method "Creative Power". She has also developed her own program "Investigator". Since 1995, Irina Yershova-Babenko is a head of Department of Philosophy and Psychology in Odessa National Medical University. She is a founder of a new scientific trend - Psychosynergetics, which studies psyche and psyche-dimensional systems/mediums from the post-non-classical conceptual-methodological positions. As a scientific author, she specializes in the field of Psychosynergetics, investigation and modeling of the behavior of the open nonlinear self-organizing systems/mediums of different nature, solving the problem of the search of the informational code.