



State of the Art Workshop
Societal Complexity

2009

Volume 20

Dorien DeTombe & Gerhard-Wilhelm Weber Editors

organized by Methodology of Societal Complexity, OR for Developing
Countries, Ethics & Centre for Business Analytics

The 23rd European Conference on Operational Research

EUROXXIII, Bonn, 2009

University of Applied Sciences, Remagen, Germany, Europe
July 5, 2009

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Dorien DeTombe & Gerhard-Wilhelm Weber (Editors)
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Mutual session of Euro Working Groups of the Operational Research Society

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University of Applied Sciences, Fachhochschule Koblenz, RheinAhrCampus Remagen,
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State of the Art Workshop

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The goal of the State of the Art Workshop on Societal Complexity 2009 is to give the Chairs of the Euro Working Groups who are doing research in overlapping fields of societal complexity such as in ethics, decision making and developing countries the opportunity to meet and discuss with each other interesting content matters in their field. In this platform top researchers have the opportunity to discuss the problematic and difficult issues in their research among each other.

In the workshop of half a day, each researcher gives a short overview of his/her research field. In this multi-disciplined research group of highly scholar and experimented researchers, the researchers have the opportunity to discuss the questions and issues in the field of societal complexity that interest them most. Each researcher gives an overview of their field, overview of recent research, a discussion about future research questions, and discuss the latest developments in research including interesting literature with a special focus on problems in research, urgent societal issues and uncertainties.

Program

- 10.00 – 10.05 Opening of the session by Prof. dr. Dorien DeTombe
- 10.05 -10.25 Prof. dr. Cathal Brugha
- 10.25 -10.45 Prof. dr. Gerhard Wilhelm Weber
- 10.45 -11.05 Prof. dr. Dorien DeTombe
- 11.05 -11.25 Prof. dr. Fred Westrop
- 11.25 -11.45 Break
- 11.45 -12.05 Dr. Annette Hohenberger
- 12.05 -12.25 Prof. dr. Alexander Makarenko
- 12.25 -12.45 Dr. Honora Smit
- 12.45 -13.05 Discussion guided by Prof. dr. Gerhard Wilhelm Weber
- 13.05 -13.15 Closing remarks by Prof. dr. Cathal Brugha

China's Relations with Europe

Prof. dr. Cathal M. Brugha

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This paper proposes a pathway to China's Globalisation and International Integration through co-operation with Europe. The starting point for putting this case is that Chinese growth has been over-focused on trade to the U.S. market; it now needs to develop new international markets, especially Europe. We then consider China's attitude to Europe and its historical and cultural similarities with Europe. We give reasons why China might wish to strengthen its relationship with Europe. We discuss the potential obstacles to such a plan, including the need to build inter-cultural trust. Having first put the case, the paper uses decision science frameworks to provide an overview of the issues and challenges involved.

On Two New Contributions to Data Mining by and within of Modern Operations Research by Optimization Theory and Computational Statistics

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In this presentation, we demonstrate the beauty of OR hosted and supported Data Mining, which became a vivid discipline with a growing number of important applications in science, technology and social sciences. In fact, we motivate and present two new contributions in Clustering Theory and in Classification Theory.

In both cases, mathematics and statistics will be very helpful, in particular, by the means of optimization theory. This presentation may serve to make some more "appetite" to vivid modern OR and to discussions at the Remagen state-of-the-art workshop.

Global safety

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Global Safety is a container concept referring to various threats such as HIV/Aids, floods and terrorism; threats with different causes and different effects. These dangers threaten people, the global economy and the stability of states. Policy making for this kind of threats often lack an overview of the real causes and the interventions are based on a too shallow analysis of the problem, mono-disciplinary and focus mostly only on the effects. It would be more appropriate to develop policy related to these issues by utilizing the approaches, methods and tools that have been developed for complex societal problems.

Handling these complex societal problems should be done multidisciplinary in stead of mono-disciplinary. In order to give politicians the opportunity to handle complex problems multidisciplinary, multidisciplinary research institutes should be created. These multidisciplinary research institutes would provide politicians with better approaches to handle this type of problem. In these institutes the knowledge necessary for the change of these problems can be created through the use of the Compram methodology which has been developed specifically for handling complex societal problems. In a six step approach, experts, actors and policymakers discuss the content of the problem and the possible changes. The framework method uses interviewing, the Group Decision Room, simulation models and scenario's in a cooperative way. The methodology emphasizes the exchange of knowledge and understanding by communication among and between the experts, actors and politicians meanwhile keeping emotion in mind. The Compram methodology will be further explained in relation to global safety in regard to terrorism, economy, health care and agriculture.

Keywords: Compram methodology, global safety, multidisciplinary research institute, policy making, OECD, terrorism, economy, health care, agriculture, complex societal problem.

State of the art in OR and ethics

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Kenneth Boulding had a vision in 1966 of OR as a tool for benevolent decision making, where rationality and computer power joined forces to develop efficient and therefore ethical methods to save 'spaceship earth'. A major branch of the OR and Ethics literature is now devoted to this purpose, where MCDA and System Dynamics are examples of methods used. The other major branch is development and implementation of Guidelines for the practice of OR. Occasionally the two meet in efforts to develop specific guidelines that, if followed, will lead to good consequences.

In parallel, a debate is going on about where is the proper place of Ethics in OR. Should ethics somehow enter the models, or should it be kept outside to preserve the scientific ideals and relegated to the OR process?

The literature in OR and Ethics draws heavily on other fields such as Decision Sciences, Psychology, Sociology, Economics, Theory of Organization and Management, and does not itself have a core set of concepts or methods.

New Mathematical Models of Social Systems and their Applications

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New models of society proposed by authors have been considered as the source of new mathematical problems and phenomena. The models had been formulated as discrete dynamical systems with presumable multivalued solutions. Also the models of opinion formation in geographically distributed social systems are described. The models are new and interesting as in applications as in the development of social systems theory. The GIS application for real modeling is described.

So in proposed talk we pose some examples of such new models and new types of their behavior as mathematical objects. First of all we describe the results on numerical calculations of behavior of some such models. Some of the examples are the next: game 'Life' with anticipation; cellular automata models of crowd's movement; neural network models of society etc. Such calculations help to illustrate the new presumable types of solutions in such mathematical objects. (multivalued periodic solutions, multivalued chaos, etc).

Also the review of presumable applications and interpretations of such models in different fields are described. The list of topics is the next: mathematical modeling of social processes; decision – making; sustainable development; complexity, brain and consciousness, micro-world, Universe.

Keywords: Society models, Opinion formation, Multivaluedness, Dynamical systems, GIS

Cognitive perspectives on climate change and sustainability

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Hitherto it has seemed that the problems related to climate change and the striving for sustainable development are ecological, economical, and technological problems that mainly have political and engineering solutions. Meanwhile, also the social, cultural, philosophical, psychological, and cognitive sciences have started to contribute to a broad and comprehensive analysis of a problem the solution of which concerns all of humanity as its major problem-owner: It is foremost humans who will be struck by climate change. It may dramatically affect the life of billions of people in various respects: their sheer existence, level of economical subsistence, pursuit of happiness, family planning, work, personal life-style, attitudes, etc. In this talk, I will develop a decidedly cognitive perspective on those topics. I will discuss in how far the human cognitive system is apt or inapt at tackling and solving the problem, on various levels of organizational complexity, individual and collective. Humans are endowed with the highest developed cognitive system in nature, comprising astonishing abilities of perception, conception, thought, language, learning, memory, reasoning, and action. Selected areas of cognitive research related to these abilities that are particularly relevant in the present context are:

(1) *Rational decision making in the face of uncertainty* (Tversky and Kahnemann 1974):

When we reason about the likelihood of an event to happen, humans are prone to several well-known biases, such as the bias of *representativeness*. Events that are unrepresentative of a class of events are judged to be less likely to happen. Since climate change is an unprecedented event (in its order or magnitude), it is unrepresentative of the class of future events, therefore people tend to ignore or downplay it.

(2) We basically have *two systems of risk perception and risk behavior* (Weber 2006):

- a. *Risk as a feeling*: an association and affect-driven hard-wired system that evokes fast, automatic, visceral reactions, in particular through recent, personal experience
- b. *Risk as a computation*: an analytic system that relies on formal logic, Bayesian statistics, probability calculus, that works slowly. It can be used deliberately and consciously by humans but lacks any affective support

Since climate change is not (yet) directly perceptible, the first risk system does not currently warn us about the threat that is ahead of us; only the second risk system can do that.

(3) *The human attention system*: If a risk, such as climate change, has entered into the center of our attention, typically a single short-term action is taken, often an individual strategy that is hopelessly “under-complex” (Welzer 2008), such as switching the light off in the dining room more often. Furthermore, we can only attend to a “finite pool of worry” (Baron 2006) whose content may change while its overall extent is limited.

(4) *Shifting baselines* (Welzer 2008): Humans tend to consider those states of the environment as “normal” that coincide with their lifetime experience. Even across a single generation baselines shift so that, for example, extreme weather conditions in the future may appear normal and expected while they were considered exceptional and threatening in the past.

- (5) *Proactive thought, abstract projectuality, mental time travel, and reverse-engineering*, (Bar 2007, Amati and Shallice 2008, Suddendorf and Corballis 2007): Among all species humans have the highest capacities of conceiving of and planning into the future. We can go on a “mental time travel” and anticipate possible future states through deliberate thought processes. Likewise, we can engage in “reverse-engineering” and identify actions that would lead to desired future states, such as sustainable development.
- (6) *The human action system* interfaces with perceptual, memory, motivational, and affective systems. For actions on a short- and medium time scale, these coordinated systems can rely on existing hard-ware (brain circuits) and automatically operating soft-ware (mental systems). A huge challenge for the human cognitive system faced with climate change and sustainability is that causes and effects are temporally and spatially disrupted. Therefore, we are facing a global *scaling-problem*: is it sufficient to just scale up our cognitive abilities to encompass large scale problems or do we need basic changes in the design of our mental faculties? If so, how may this happen in the short period of time that is left for a solution?
- (7) The necessity for a global impact fosters *systemic thinking* and *distributed cognition*: Any solution to those problems must stem from a concerted effort of all of humanity, through bottom-up and top-down processes. Single individuals acting locally, as in grass-root movements, can make a global impact. Companies, institutions, countries, and inter-governmental organizations can act on a global level, as individuals.

With this selective review of relevant topics from a cognitive science perspective on climate change and sustainability I want to open the floor to an interdisciplinary discussion with the various workshop members, extending into the following EURO-OR conference.

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Health facilities in developing countries: location for sustainability

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My interest is in location theory and other aspects of optimisation that contribute to sustainability of healthcare facilities in developing countries. In this respect, healthcare facilities might consist of a number of health workers in villages who can deliver a service to their neighbours or those from surrounding villages. A mobile health clinic could be routed around an area to offer medically trained help from different premises. A field centre could be operated by a hospital in a region where residents have little opportunity to access quality healthcare, offering temporary but regular access to procedures such as cataract removal. A community healthcare centre could be established giving basic primary health care in a remote rural region. In all these situations, optimisation theory can offer solutions in areas such as location and vehicle routeing that can contribute to establishing sustainable facilities. However, many difficulties arise of applying solutions at the point of decision making. Experience has shown that contacting and collaborating with planners in these areas is hard to initiate and follow through.