

CRAG - IRGC Symposium 2013

PLENARY SESSION 1 UNDERSTANDING AND MANAGING UNCERTAINTY

Wednesday, November 20, 13:00 – 17:00, BC 420

SPEAKER ABSTRACTS AND BIOGRAPHIES

Philippe GILLET

EPFL President ad interim, IRGC Chairman

BIOGRAPHY. Philippe GILLET is EPFL president a.i. and Chairman of IRGC. He joined EPFL in 2010 as Vice-president of Academic Affairs and full professor. He completed his undergraduate studies in Earth Science at Ecole normale supérieure de la rue d'Ulm (Paris) and obtained in 1983 a PhD in Geophysics at Université de Paris VII. After a State Doctorate in 1988, he became a Professor at this same university, which he left in 1992 to join Ecole normale supérieure de Lyon. The first part of his research career was devoted to the formation of mountain ranges – particularly of the Alps. In parallel, he developed experimental techniques (diamond anvil cells) to recreate the pressure and temperature prevailing deep inside planets in the lab. These experiments aim at understanding what materials make up the unreachable depths of planets in the solar system. Philippe Gillet is also active in science and education management. He was the Director of the CNRS Institut National des Sciences de l'Univers (France), the President of the French synchrotron facility SOLEIL and of the French National Research Agency (2007), and the Director of Ecole normale supérieure de Lyon. Before joining EPFL he was the Chief of Staff of the French Minister of Higher Education and Research.

Charles KLEIBER

IRGC Vice-Chairman

BIOGRAPHY. Charles Kleiber obtained a diploma (MA) in architecture at the Ecole Polytechnique Fédérale de Lausanne in 1968 and went on to work as an architect until the end of the 1970s, both as an independent and as a consultant specialising in hospital architecture. At the same time, he became involved in problems relating to economic incentives in the field of health. In 1981 he was appointed head of Service for Public Health and Health Planning of the Canton Vaud. In 1990, he switched full time to the health care domain and presented his PhD thesis on the impact of economic incentives on performance in medical care. The thesis was awarded the Hauser Prize of the University of Lausanne and was published in 1991 by Payot Lausanne under the title "Questions des soins" (Questions of medical care). The following year, he was appointed director general of the university hospitals of Lausanne. He also taught at the Institute for Economy and Health Management at the University of Lausanne. In October 1997, Charles Kleiber was appointed State Secretary for Education and Research. He held this post for more than ten years. During his tenure, scientific research and higher education were significantly strengthened; new centers of excellence were established, international cooperation was intensified, resources for science were greatly increased, and a constitutional amendment was adopted, paving the way for a national area for science and research. Charles Kleiber published several pleas in favour of the knowledge economy, and held numerous conferences on this theme (many collected in "Créer", Favre ed., Lausanne, 2006). Charles Kleiber continues his action in favour of science and culture. He is president or member of different scientific and cultural institutions, in Switzerland and in Europe. He received several academic distinctions.

Wolfgang KRÖGER

Executive Director, ETH Zürich Risk Center

RISK GOVERNANCE: OVERCOMING SILO THINKING AND APPROACHES

The prevailing state of research and governance regimes are sometimes characterized by "silo thinking", i.e. compartmentalized, disciplinary and sectorial, fragmented, which is in contrast to evidenced needs. Increasing integration and interconnectedness of systems has been yielding behavioral patterns of a complex "system-of-systems" with cascading spread of disturbances, feedback loops, etc. We are facing widening gaps between designing and operating systems like power grids and our knowledge about them; patterns of recent major blackouts have proven the importance of contextual factors and the need for a paradigm shift towards resilience; the Fukushima Dai-ichi disaster clearly demonstrated that systems, predefined as "closed", may turn into open systems under severe accident conditions closely interacting with their socio-political-physical environment, that adequate communication is essential and trade-offs need to be respected. This calls for a fundamentally new (systems) thinking, fostered joint research to overcome the limitations of classical methods and frameworks to better understand complexity and platforms for global dialogue as well as concepts which integrate disciplines, procedural steps and actors. The foresighted establishment of the IRGC and early development of the risk governance core concept and the more recent creation of the ETH Risk Center and initiated novel research (including the proposed program on Future Resilient Systems to be funded by NRF Singapore) are encouraging but still increasable steps to master the above challenges.

BIOGRAPHY. Wolfgang Kröger has been Ordinarius of Safety Technology at the ETH Zürich since 1990 and director of the Laboratory for Safety Analysis. Before being elected Founding Rector of the International Risk Governance Council (IRGC) in 2003 he headed research in nuclear energy and safety at the national Paul Scherrer Institut (PSI), where he was also on the board of directors. After his retirement at the beginning of 2011 he has become the executive director of the newly established ETH Risk Center. He studied mechanical engineering, specialized on nuclear technology - at the RWTH Aachen, completed his doctorate in 1974 and his habilitation thesis in 1986. Professor Kröger has been chiefly involved in nuclear safety issues and methodical improvements pertaining PSA for nuclear power plants but also in modelling, analysis and optimization of complex technical systems. He is engaged in putting the assessment and management/governance of technological risks into a broader context, in substantiating concepts of sustainability and resilience, and in providing tools for multi-criteria decision-making processes within integrative risk management. Inter alia he is an individual member of the Swiss Academy of Engineering Sciences, has been active in various committees and advisory boards including chairmanship of the EBRD Safety Review Group and authored numerous publications. Recently has been awarded "Distinguished Affiliate Professor" by the TU Munich and has become a member of the JANSI Technical Review Committee.

Janet HERING

Scientific Director, CRAG; Director, EAWAG; Professor, ETH Zürich, EPFL

BIOGRAPHY. Janet Hering is the Director of the Swiss Federal Institute of Aquatic Science & Technology (Eawag) and Professor at the Swiss Federal Institutes of Technology (ETH) in Zürich and Lausanne. From 1996 to 2006, she was a Professor at the California Institute of Technology (Caltech). Prior to 1996, she was an Assistant and later Associate Professor at UCLA. She has degrees in chemistry from Cornell and Harvard Universities and a Ph.D. in oceanography from the Massachusetts Institute of Technology-Woods Hole Oceanographic Institution Joint Program. Her research interests include water resources and water infrastructure management, the biogeochemistry of trace elements, and water treatment technologies for the removal of inorganic contaminants from potable water.

Benjamin ZWEIFEL

Avalanche Forecaster, Swiss National Institute for Snow and Avalanche Research SLF

AVALANCHE RISK IN RECREATIONAL ACTIVITIES: HOW PEOPLE DEAL WITH UNCERTAINTY

Snow avalanches are a main natural hazard in mountain terrain. Most avalanche victims (more than 90%) are caught during recreational activities in uncontrolled avalanche terrain. Prevention requires not only a better understanding of the physical aspects of avalanches but also in-depth investigation of human factors in the decision-making process of individuals and groups. Both aspects involve uncertainty. First, considering spatial variability, it is difficult to understand or model the physical processes of snow cover. Second, group dynamics or heuristic traps in human-decision making process are elusive and have only been marginally investigated. Research is hampered by the missing feedback from incidents and accidents. Our research on avalanche safety focuses on the human dimension of avalanche uncertainties. Our finding indicates that less overconfidence and more self-control of the decision-making should help improve safety of people exposed to avalanches.

BIOGRAPHY. Benjamin Zweifel holds a master in earth sciences and glaciology from the ETH in Zürich including field work at the Bolivian Illimani for his master thesis. He has been working as an avalanche forecaster for the Swiss National Avalanche Warning for more than 10 years. Dealing with uncertainties in risk management is a key factor in his daily work as an avalanche expert. Currently, Benjamin is completing a PhD with Prof. Dr. Boutellier at ETH Zürich focusing on group dynamics and decision making in recreational activities. He just returned from an 8-months study program at SFU in Vancouver. Beside his studies and professional work, Benjamin has always been an excited mountaineer and has climbed the Alps, parts of the Himalaya and Cordillera Blanca.

M. Granger MORGAN

Professor and Head, Department of Engineering and Public Policy, Carnegie Mellon University

UNCERTAINTY: AN INTRODUCTION

Uncertainty is ubiquitous. In our private lives we decide where to go to university, what to study, what job to take, who to marry, whether to have children, all in the face of considerable, often irreducible, uncertainty. Governments, private firms and other organizations face similar challenges. This talk will briefly identify many of the principle sources of uncertainty, discuss strategies for characterizing and analyzing uncertainty, outline how people think about and perceive uncertainty, and then summarize methods for making decisions in the face of uncertainty.

BIOGRAPHY. Granger Morgan is Professor and Head of the Department of Engineering and Public Policy at Carnegie Mellon University where he is also University and Lord Chair Professor in Engineering. He is also a Professor in the Department of Electrical and Computer Engineering and in The H. John Heinz III School of Public Policy and Management. Professor Morgan holds a BA from Harvard College (1963) where he concentrated in Physics, an MS in Astronomy and Space Science from Cornell (1965) and a Ph.D from the Department of Applied Physics and Information Sciences at the University of California at San Diego (1969). He is a member of the US National Academy of Science, a Fellow in several professional societies, and is involved in a wide variety of advisory roles. His research addresses problems in science, technology and public policy. Much of it has involved the development and demonstration of methods to characterise and treat uncertainty in quantitative policy analysis. He works on risk analysis, management and communication; on problems in climate change and moving to a low-carbon energy system, focused particularly on electric power; on improving health, safety, and environmental regulation; and on several other topics in technology and public policy.

Ben ALE

Emeritus Professor in Safety Science and Disaster Management, TU Delft

RISK, WHOSE WORTH'S UNKNOWN, ALTHOUGH HIS HEIGHT BE TAKEN

Since its inception, Quantitative Risk Analysis has evolved from a form of witchcraft to a science. But how to make decisions under risk and uncertainty remains an important challenge in the process of risk management. This is primarily because there is no agreement on the level and nature of acceptable risk. For instance, it is hard to impute a value on human life, health and happiness. The availability of relevant information across decision contexts also varies: there is more information about how to operate chemical plants than for calculating the optimal height of sea defences, and even less information for decisions regarding underground storage of carbon dioxide or shale gas resources. When critical information is lacking, uncertainties around costs and benefits can escalate. To inform decisions, the risk management community, scientists, managers and politicians should address these uncertainties by exercising sound technical, economic and ethical judgments.

BIOGRAPHY. B.J.M. Ale is emeritus professor at TU-Delft in Safety Science and Disaster Management. He still is visiting professor in Risk Management at the University of Ghent and at the University of Antwerp. Ben Ale is globally known for his pioneering work in risk management and governance. Among others Ben Ale was responsible for formulation of the policy for third party risk in the Netherlands. He led the development of risk quantification methods for chemical industries, occupational risk and air transportation risk. His most recent work included the development of methods to incorporate uncertainty in quantification analyses using Bayesian Belief Nets.

Wändi BRUINE DE BRUIN

Professor of Behavioral Decision Making, Centre for Decision Research Leeds University

UNDERSTANDING AND ADDRESSING PUBLIC PERCEPTION OF HAZARDS AND UNCERTAINTY

As members of a democratic society, individuals face complex decisions about how to respond to natural and man-made hazards as well as associated policies. To inform people's decisions, governmental and non-govern-

mental organizations often aim to provide understandable and scientifically accurate communication materials. Such communication efforts may fail if communication designers do not understand the informational needs of their intended audience. In this presentation, I will review the main lessons learned from social science about public perceptions of hazards and uncertainty, and how to address them in communications.

BIOGRAPHY. Wändi Bruine de Bruin is Professor of Behavioral Decision Making at the Centre for Decision Research of the Leeds University Business School (UK), and Associate Professor of Engineering and Public Policy at Carnegie Mellon University (US). She studies how people make decisions and how to develop communications so as to help people to make more informed decisions. Applications include energy use, personal health, and household finance. Among other things, she has studied public perceptions of energy use and conservation, climate change and smart meters. She is a member of the Scientific and Technical Council at the International Risk Governance Council.

Richard DE NEUVILLE

Professor of Engineering Systems and of Civil and Environmental Engineering, MIT

FLEXIBILITY IN SYSTEMS PLANNING AND DESIGN

Flexibility in Design is an effective way to manage uncertainty. It enables system managers to adapt to evolving environments, to avoid bad situations and take advantage of emerging good opportunities. It is a strategic approach that views systems management as a dynamic process in which designers necessarily add or change capacities and capabilities over time. Flexibility in design is most desirable when the future is most uncertain, exactly when options are most valuable. In contrast with Robust Design which minimizes the variation of future system performance, Flexible Design redistributes the variation in performance, reducing the downside possibilities while maximizing upside potential. The presentation outlines the process of achieving Flexible Designs, and demonstrates its operation and value through examples. The analysis maximizes overall expected system value. It starts with explicit recognition of underlying uncertainties – in sharp contrast to conventional systems design based on fixed system requirements. The process explores the distribution of possible outcomes associated with alternative design concepts, generally by Monte Carlo simulations. Example applications indicate that Flexibility in Design routinely leads to 10 to 30% increases in expected value.

BIOGRAPHY. Dr. de Neufville, Professor of Engineering Systems and of Civil and Environmental Engineering at MIT, founded the MIT Technology and Policy Program. He has written Flexibility in Engineering Design and 5 other major texts. Numerous prizes have recognized his work, including the Sizer Award for the Most Significant Contribution to MIT Education. His work now focuses on inserting flexibility into technological systems. It implies a fundamental shift in engineering design, from a focus on fixed specifications, to a concern with system performance under the range of situations that could occur. He has an MIT PhD and a Delft DrHc.

Antoine BOMMIER

Professor and Chair of Integrative Risk Management and Economics, ETH Zürich

MODELS-AS-USUAL FOR UNUSUAL RISKS? ON THE VALUE OF CATASTROPHIC CLIMATE CHANGE

A substantial part of the economic literature on climate change discusses climate policy as an intertemporal trade-off, where the costs of an early intervention are compared with the costs of later measures. As the problem is similar to that of investment under uncertainty, standard methods from Finance are generally used. However, recent literature on climate change shows an increasing concern for the risk of abrupt and irreversible changes in the climate system. The relevant trade-off is no longer that of present consumption versus future consumption, but that of consumption versus a risk of catastrophic climate change. The presentation discusses to what extent standard approaches can still be used to evaluate the cost of climatic change. It highlights the importance of the intertemporal preference specification when considering the trade-off between consumption and risk reduction.

BIOGRAPHY. Antoine Bommier (1968) holds the Chair of Integrative Risk Management and Economics at ETH Zürich. He is member of the ETH Risk Center and of the Center of Economic Research at ETH Zürich. His research focuses on the economics of risk and includes both theoretical and applied contributions.

Antoine Bommier studied at Ecole Normale Supérieure and Ecole Polytechnique, from which he obtained a Ph. D. in Mathematics in 1993. Before joining ETH Zürich Antoine Bommier worked for CNRS, Toulouse School of Economics, the Institut National d'Etudes Démographiques, Sciences-Po Paris, and the University of California, Berkeley.