DECISION-MAKING UNDER DEEP UNCERTAINTY

eci

UNIVERSITY OF OXFORD

OXFORD MARTIN SCHOOL

ITRC mistral

DMDU
a multi-disciplinary association of professionals
dedicated to improving
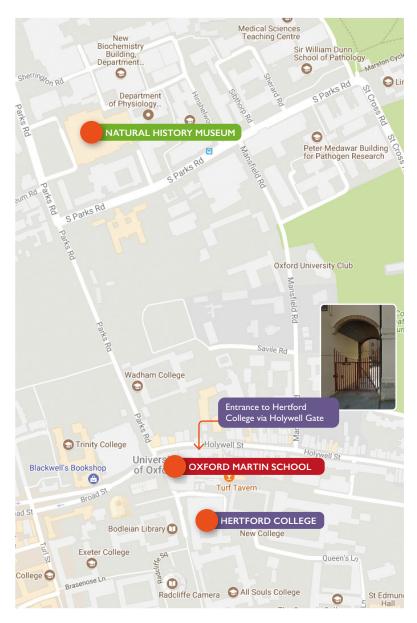decision making under deep uncertainty

Venue

All workshop sessions will take place at the Oxford Martin School.

Delegates have the choice of taking lunch either in the Oxford Martin School or in the Baring Room of nearby Hertford College.

A small selection of posters will be in the Oxford Martin School, with more on display in the Baring Room at Hertford College.

Hertford College is a short walk (50m) from the Oxford Martin School, and you will need to enter the College by the Holywell Gate on Holywell Street – please see the map, or ask one of the event organising team.

There will be stewards at the Holywell Gate to direct you to the Baring Room where a buffet lunch will be served.

Hertford College safety information:

To comply with fire regulations, you will be asked to give your name as you enter/leave Hertford College, so that there is an accurate list of who is on site. You will also be given a safety briefing, and exit routes will be indicated. If there is an alarm, please evacuate the building immediately – do not stop to pick up any belongings. Assemble in the HW quad and do not to leave until directed and accounted for on the attendance register. You should not re-enter the building until directed by a Fire Officer or a designated member of Hertford staff.

Welcome

I am delighted to welcome you to Oxford for the 2017 Decision-making under Deep Uncertainty (DMDU) workshop. Having started life in 2013 as a meeting of a small number of DMDU aficionados, the workshop has become established as an annual fixture with a growing number of participants. The early enthusiasm for applications in climate change adaptation and water resources planning has flourished and diversified into the wide range of topics we see in this year's symposium, which includes applications in security, cities, business and several domains of public policy. The focus for this year's workshop is "Dealing with deep uncertainty in decision-making across multiple scales", recognising the interconnections between global change, national governments and local decision makers in today's complex and interconnected world.

The DMDU community has always been motivated by problems of practical application, but also subscribes to James C. Maxwell's maxim that "there is nothing more practical than a good theory". Accordingly, this year's programme is dominated by practical perspectives but also contains developments in theory and methodology. We particularly welcome practitioners who are coming to DMDU for the first time. We have designed the programme to provide space to engage with the new challenges that you bring our community.

We are very grateful to the Oxford Martin School for offering the use of their splendid building for this year's workshop. The Oxford Martin School has a mission to engage the best of Oxford scholarship with the challenges of the 21st Century and beyond, so it is very fitting that the School should host the world's forum for dealing with the profound uncertainties about the future. I am also enormously grateful to Miriam Mendes and Kay Jenkinson who have handled the administration of the conference, in addition to their usual roles of supporting the UK Infrastructure Transitions Research Consortium (ITRC). Several other researchers and graduate students within the ITRC family have also contributed to the planning and running of the workshop, for which I am most grateful.

I hope you have a very stimulating DMDU workshop and enjoy your time in Oxford.

Jim W Hall FREng

Professor of Climate and Environmental Risks

Director, Environmental Change Institute
University of Oxford

Training day programme

| 13 November

09:30	DMDU and overview of the day
	Who are we? stand-up introduction exercise
10:00	Interactive exercise:
	What is deep uncertainty and what does it mean in practice?
11:00	Break
11:15	Generalised framework for DMDU methods:
	A guide for the rest of the day
12:15	Lunch
13:15	Introductory demonstrations and applications
15:45	Break
16:00	Substantive overview:
	Decision-making under Deep Uncertainty: From Theory to Practice (Springer Verlag, forthcoming)
16:30	Plenary panel and Q&A
	What is in the DMDU analyst's tool kit?

Workshop programme: Day 1

14 November 2017

09:30 Welcome & introduction

Prof Jim Hall, University of Oxford
Robert Lempert, Director, RAND Corporation & Jan Kwakkel, Delft University of Technology

09:40 Global scale keynote address:

Informing policy decision-making with Foresight methodologies
Claire Craig, Director of Science Policy, Royal Society

Further details on pages 8–9

10:10 Panel discussion including:

Jerry Ravetz, Associate Fellow, James Martin Institute for Science & Civilisation, University of Oxford
Angela Wilkinson, Senior Director, Scenarios & Insights, World Energy Council
Klaus Keller, Professor of Geosciences, Penn State University
Warren Walker, Professor of Policy Analysis, Delft University of Technology

10:40 Coffee

11:10 Problem-solving parallel interactive sessions

National defence & security – Plenary room

Jim Maltby, Defence & Security Analysis Division, Defence Science and Technology Laboratory (DSTL) – Plenary Room

Further details on pages 8–9

Water, floods and coastal adaptation – Breakout room 1

Judy Lawrence, Senior Research Fellow, Climate Change Research Institute, Victoria University of Wellington – Breakout room, limited to 45 participants

Further details on pages 8–9

12:30   Lunch and posters

The two venues for lunch & posters are the Oxford Martin School & nearby Hertford College

14:00   Perspectives from national and regional scales:

Long-term planning in Small Islands Developing States under a changing climate
Julie Rozenberg, Economist, World Bank Sustainable Development Group

Integrated systems method – identification of policy options for a complex wicked problem
Leena Ilmola Sheppard, International Institute for Applied Systems Analysis, (IIASA), Futures Committee of the Finnish Parliament

15:00   Break

15:30   Problem-solving interactive session:

DMDU in emergency and real time situations – Plenary room

Tina Comes, Delft University of Technology & University of Agder
Bartel Van de Walle, Delft University of Technology

Further details on pages 8–9

16:30   Tools and models demonstration showcase

E-rise – Ivan Haigh, University of Southampton

Pumping Station Simulation & Testing (PSST) model –Jos Timmermans, Delft University of Technology

Designing a signal system for timely adaptation – Marjolijn Haasnoot, Deltares

Criticality and vulnerability assessment of the multi-modal transport network of Bangladesh – Jan Kwakkel, Delft University of Technology

Rhodium – an open source Python library for robust decision-making – Julianne Quinn, Cornell University

NISMOD-INT Platform – Scott Thacker, United Nations Office for Project Services (UNOPS)

17:45   Close of workshop day 1

18:30   Reception and buffet dinner at the Oxford Museum of Natural History

Programme information: Day 1

09:40 KEYNOTE SPEAKER

Informing policy decision-making with Foresight methodologies

Claire Craig, Director of Science Policy, Royal Society

The UK's Foresight futures programme, reshaped by the then Government Chief Scientific Advisor in the early 2000's, deliberately adopted a range of futures approaches. These included quantitative modelling, qualitative scenarios, simulation and gaming, visioning, fictional narratives and roadmaps. Projects were intended primarily to inform decision-making by government; with business, research funders, regulators and third sector organisations all also being significant participants and actors.

More than a decade after the first projects reported their findings, this paper reviews some of the key methodological learnings from Foresight and from futures work with decision-makers in the US and the European Commission. It draws on studies of issues such as UK flood risk, obesity, the impact of climate change on global migration, computer-based trading in financial markets, and the history of the future of cities.

Drawing both on Foresight and on wider experience of the use of science in decision-making, the paper discusses the sustained power of investment in significant cross disciplinary evidence synthesis; and the influence of models, particularly – but not only – computational models, as tools to think, and places for convening discussion with decision makers, wider stakeholders and with the public. It ends with some speculations about the interaction between futures work carried out primarily to inform professional decision-making and its role in enabling wider public engagement; and asks how and when it will also be possible for futures work to engage, with rigour, with the wide range of public narratives about the future in areas such as AI and robotics.

11:10 PROBLEM-SOLVING PARALLEL INTERACTIVE SESSIONS

National defence & security

Jim Maltby, Defence & Security Analysis Division, Defence Science and Technology Laboratory (DSTL)

Plenary Room

The purpose of this session is to seek new ways of addressing difficult defence and security problems, characterised by deep uncertainty, by engaging relevant academics/academic networks, industry and allies. We intend to do this though gaining insights that can shape our own internal work, joint/collaborative working with external partners, supporting UK Research Council applications and direct funding of external exploratory work. We are interested in:

- identifying and exploiting emerging tools & techniques or existing tools & techniques already used in other applications

- influencing the direction of research into new tools & techniques

Water, floods and coastal adaptation

Judy Lawrence, Senior Research Fellow, Climate Change Research Institute, Victoria University of Wellington

Please note that this session takes place in Breakout Room 1 and has a maximum capacity of 45.

A sharing of real-life examples of the application of tools for decision-making under deep uncertainty and decision implementation and monitoring in the water and coastal problem domains. The focus is on the practical application of DMDU methodologies and implementation issues such as monitoring. Five practice examples will be shared followed by an interactive session to discuss these in groups using your own practice problems.

- **Stephen Daysh** – Community based decision-making under an uncertain future: Climate change adaptation in Hawke's Bay, New Zealand with Graeme Hansen and Rob Bell

- **Steve Moncaster** – Water Resources East project; a multi-sector strategic water resource planning project Anglian Water UK with Julien Harou

- **Pieter Bloeman** – Dutch Delta Plan implementation and monitoring with Jos Alphen and Marjolijn Haasnoot

- **Laurna Kaatz** – Deep Uncertainty in Practice: Adopting New Planning Processes at Denver Water USA with Rebecca Smith

- **Jayantha Obeysekera** – Resilient South Florida: challenges in addressing deep uncertainty South Florida Water Management District USA with Laurens Bouwer

The presenters will address the following:

- How uncertainty and change has been integrated into their decision problem
- What was learned
- The critical enablers that shifted decision-making thinking toward managing long term risks or hindered it

Following the presentations, participants will choose two presentations and move around the tables twice joining the presenters in café style, followed by a plenary session to report the results and reflect on them. There will be a live feed for those unable to be present.

Programme

- Introduction – 5min
- Presentations – 30 min
- Café discussions – 40 min
- Plenary reporting and Q&A – 15 min

▌ 15:30 PROBLEM SOLVING SESSION

DMDU in emergency and real-time situations

Tina Comes, Delft University of Technology & University of Agder, and Bartel van de Walle, Delft University of Technology

The purpose of this interactive session is to explore how deep uncertainty methods can be adapted to make decisions when time is critical and becomes a driver of uncertainty. Based on two case studies from humanitarian disaster response, we will discuss the interdependence of different (temporal, geographical, and hierarchical) scales and how this interdependence is represented in information and decisions.

Workshop programme: Day 2

15 November 2017

09:30 City-scale keynote address

Engineering options analysis for infrastructure decision-making
Richard de Neufville, Prof of Engineering Systems, MIT Institute for Data, Systems, and Society

Further details on pages 12–13

10:00 Panel discussion including:

Felix Creutzig, Head, Land Use, Infrastructures & Transport, Mercator Research Institute on Global Commons and Climate Change
Alex Harvey, Climate and Environment Adviser, UK Department for International Development (DFID), Africa Regional Department
Alex Nickson, Thames Water
Tim Reeder, Independent consultant, formerly of the UK's Environment Agency

10:20 Problem-solving interactive session

Adaptation by Design – a pathways approach for urban planning and spatial design

Sadie McEvoy, Faculty of Technology, Policy and Management, Delft University of Technology
Taneha Kuzniecow-Bacchin, Delft University of Technology

Further details on pages 12–13

11:20 Coffee

11:40 Parallel sessions – abstracts listed on pages 34–40

Global and regional scales – Plenary room

A large ensemble framework for consequence driven discovery of climate change scenarios
Jonathan Lamontagne, Tufts University

Uncertainty in epidemiological models of the Ebola epidemic
Scott Janzwood, University of Waterloo

Comparative pathways for regional energy transition under deep uncertainty
Mark Hughes, University of Pensylvania

Water abstraction agent-based model
Henry Leveson-Gower, Defra

National and city scales – Breakout room 2

Local interpretation of the shared socioeconomic pathways
Jude Herijadi Kurniawan, University of Waterloo. Talk given by Vanessa Schweizer

Bangladesh Delta Plan 2100: A challenge in meeting the uncertainties of long-term planning
Giasuddin Choudhury, BDP2100 Bangladesh

Certain to deeply uncertain: a decision-making teaser
Judy Lawrence, Victoria University of Wellington

Local and individual scales – Breakout room 1

Configurational conditions that enable public sector organizations to take forward-looking decisions: An fs QCA analysis of municipal investment decisions in the Netherlands
Pot Wieke, University of Wageningen

Forest management under deep uncertainty – decision support vs. decision-making
Roderich von Detten, University of Freiburg

Minimising information needs: how does decision-making under deep uncertainty do it?
Joseph Guillaume, Aalto University

Does robust decision-making mirror thinking under uncertainty: how psychology may help us understand the validity of DMDU approaches?
Jim Maltby, Defence Science and Technology Laboratory

13:20   Lunch and posters

There are two venues for lunch and posters, the Oxford Martin School and nearby Hertford College

14:45   Feedback from parallel sessions

15:15   Insights from the cutting edge of DMDU

Role of scenarios in decision support under deep uncertainty: psychological evidence and anthropological possibilities
Robert Lempert, Director, RAND Corporation, Frederick S. Pardee Center for Longer Range Global Policy & the Future Human Condition and Sara Turner, Pardee RAND Graduate School

Transcending uncertainty
Gwythian Prins, London School of Economics

Morality, uncertainty and policy
Yakov ben Haim, Faculty of Mechanical Engineering, Technion

Questions & discussion

16:45   Reflections on workshop and plans for 2018

Robert Lempert, Director, RAND Corporation & Jan Kwakkel, Delft University of Technology

17:15   Workshop close

Programme information Day 2

❚ 09:30 CITY SCALE KEYNOTE ADDRESS

Engineering Options Analysis for Infrastructure Decision-Making

Richard de Neufville

The talk presents Engineering Options Analysis (EOA) as a quantitative approach to planning, design, and management of infrastructure over time, in the context of uncertainty. Using simulation, it explores the distribution of consequences of alternatives. The talk underlines important differences between EOA and Real Options analysis (ROA). Although these sound similar, they are really different. ROA assumes that we can estimate future uncertainties accurately, and focuses on pricing a single option. EOA easily deals with deeper uncertainties, handles multiple options, allows for many measures of value, and develops insights into desirable policies over time.

The product of an Engineering Options Analysis is a strategy, such as a good chess player might develop. It guides us to make modest initial commitments that provide the basis for responding to the range of future needs and opportunities as they arise. EOA achieves this by systematically examining the contributions of prospective options, of alternative forms of flexibility in engineering design.

The Liquid Natural Gas (LNG) case demonstrates the kind of insights that EOA provides. It highlights the advantages of flexibility in size, time, and location of facilities. It develops the important insight that modular designs may outperform monolithic designs because they reduce the risk of overdesigned plants, and increase opportunities to take deal with needs when and where they occur.

The prospects for EOA are good. Analysts constantly uncover new opportunities. Moreover, their work collectively documents the need to change the paradigm of systems engineering design. Instead of starting with fixed requirements, we need to acknowledge that needs change over time, and that we should be able to adapt infrastructure easily to new circumstances.

❚ 10:20 PROBLEM-SOLVING INTERACTIVE SESSION

Adaptation by Design – a pathways approach for urban planning and spatial design

Sadie McEvoy, Faculty of Technology, Policy and Management, Delft University of Technology

Urban planning is a decision-making process beset by deep uncertainties stemming from the complexities of socio-technical systems and their dynamics in time, especially under changing climate, economic and demographic conditions. In urban planning, however, there is also a critical spatial dimension to decisions, which introduces new uncertainties that play out at different scales and over different timelines. Furthermore, urban planning requires designing for multiple performance objectives, from mobility to economic development and water management, that together make up quality of life. Adaptation by Design is a pathways approach being used in urban planning to design spaces in a way that accounts for changing conditions and uncertainty about the future. The novelty in Adaptation by Design is that the pathways explicitly account for both the spatial and temporal dimensions, across different scales.

This session will introduce the Adaptation by Design approach and focus on how it addresses three key challenges common to many adaptive and adaptation planning fields: synergies and trade-offs, tipping points, and cascading effects of decisions. This session will use an interactive format to exchange knowledge and lessons between the different disciplines engaged in decision-making under deep uncertainty. This exchange aims to inform and enrich Adaptation by Design and practice in other disciplines.

Eating out

In central Oxford, bustling George Street has reliable restaurant chains, while Little Clarendon Street is quieter with a selection of good places to eat. Jericho, centred on Walton Street, has plenty of pubs, some of which serve good food too. A little further afield, Cowley Road has independent bars, pubs and restaurants with a lively, international feel.

For more information about Oxford, go to www.experienceoxfordshire.org

The Society for Decision Making under Deep Uncertainty is a multi-disciplinary association of professionals dedicated to improving decision making under deep uncertainty.

Our goals

Research

Improve understanding and advance the capabilities of theory, methods, and tools for decision making under deep uncertainty.

Practice

Help public and private sector organizations make better decisions by encouraging widespread practical application of the knowledge, methods, and tools for decision making under deep uncertainty.

Education and training

Provide training and training materials for scholars, practitioners, decision makers, and the public.

Dissemination

Disseminate knowledge about decision making under deep uncertainty methods and tools, and their applications in practice.

Career development

Help members to pursue and develop their careers in decision making under deep uncertainty.

Community

Provide a community and a professional network where members can share ideas, foster collaboration, benefit from support and feedback, and be inspired and energized through interactions with their peers.

www.deepuncertainty.org/

The Society would like to thank: the Oxford Martin School for hosting this year's event; and the ITRC-MISTRAL programme at the University of Oxford's Environmental Change Institute for organising our workshop and training day.