

informs **DECISION** **ANALYSIS** **SOCIETY** 

DECISION

ANALYSIS

TODAY

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The newsletter of the INFORMS Decision Analysis Society

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President’s Letter

Jason Merrick



Dear DAS Members,

2017 was an excellent year for decision analysis. Many of us met at the INFORMS annual meeting in Houston in October. Our own Bill Klimack was the general chair for a great conference. Andrea Cadenbach and Saurabh Bansal put together twenty-eight great sessions for DAS, along with the “Meet the Editors” and “Journey to Organizational Decision Quality” panels. Casey Lichtendahl and Yael Grushka Cockayne also put together a fascinating associated track on forecasting. I would be interested to hear which sessions you enjoyed most.

Looking forward to 2018, we welcome Eva Regnier of the Naval Postgraduate School and Léa Deleris of IBM to the council. I have also appointed Saurabh Bansal to serve the remainder of Melissa Kenney's term after her move to secretary/treasurer. Heather Rosoff, Matthias Seifert, and Emanuele Borgonovo will continue to serve on the council. I would like to thank Joe Hahn and Debarun Bhattacharjya for their excellent service on the Council as their terms (but not their work) come to an end.

Eva and Léa have already taught me a new word, as I have apparently "voluntold" them to serve as chairs of a new committee looking at how the society can help mid-career researchers and practitioners in their career progression. This initiative will run in parallel to the committee chaired by Matthias Seifert on mentoring students and early career members. The mentoring committee ran a "coffee with a member" program at the meeting in Houston, giving seventeen young decision analysts the chance to meet with more senior members. I had the opportunity to meet with Beste Basciftci, a Ph.D. student at Georgia Tech, for a thoroughly enjoyable chat. Expect to hear more from the mid-career and the mentoring committee in the coming year. Please contact any of the DAS leadership with thoughts and ideas, or you can always contact me with your comments.

We are already planning the next Advances in Decision Analysis conference for June 2019. The meeting will be chaired by Emanuele Borgonovo and held at Bocconi University in Italy, the conference's first visit to Europe and what a beautiful setting. I encourage you to save up your travel funds to enjoy a great meeting and maybe an extended stay after the conference.

This year, we will have some excellent decision analysis talks at the INFORMS Analytics conference in Baltimore in April. The meeting is chaired by our own Jack Kloeber, and Don Kleinmutz will give a keynote. We will also have another great set of sessions organized by Saurabh Bansal and Christian Wernz at the INFORMS Annual Meeting in Phoenix in November, where I will pass the reigns of DAS to Karen Jenni. You may remember that Karen will be the first full-time practitioner to serve as president of the society since Peter Morris and Ralph Keeney led the Society in the 1980s. I am excited to see what 2018 will bring.

Jason Merrick

Virginia Commonwealth University

Officers and INFORMS Business	2017-2018	2016-2017
President	Jason Merrick	Jason Merrick
President-Elect/Vice President	Karen Jenni	Karen Jenni
Past-President	Eric Bickel	Eric Bickel
Secretary-Treasurer	Melissa Kenney	Yael Grushka-Cockayne
Council member (1st year)	Léa Deleris	Heather Rosoff
Council member (1st year)	Eva Regnier	Matthias Seifert
Council member (2nd year)	Heather Rosoff	Melissa Kenney
Council member (2nd year)	Matthias Seifert	Emanuele Borgonovo
Council member (3rd year)	Saurabh Bansal	Debarun Bhattacharjya
Council member (3rd year)	Emanuele Borgonovo	Joe Hahn
Representative to Subdivisions Council	Karen Jenni	Karen Jenni

Committees	2017-2018	2016-2017
Awards Committee (Standing)	Jason Merrick	Jason Merrick
Membership Committee (Standing)	Mehmet Ayvaci & Jay Simon	Jun Zhuang & Mehmet Ayvaci
Nominating Committee (Standing)	Karen Jenni	Karen Jenni
Mentoring Committee (Special)	Matthias Seifert	-
Mid-Career Committee (Special)	Eva Regnier & Léa Deleris	-
DAS Webinar Committee (Special)	Karen Jenni	Eric Bickel
Communications	2017-2018	2016-2017
DAS Today Editor(s)	Debarun Bhattacharjya & Cameron MacKenzie	Debarun Bhattacharjya & Cameron MacKenzie
DAS Website/Social Media	Jay Simon	Jay Simon

Awards	2017-2018	2016-2017
Ramsey Medal Committee	Eric Bickel	Eric Bickel
Practice Award Committee	Mike Runge & Matt Fitch	Greg Hamm
Publication Awards Committee	Erin Baker & Canan Ulu	Vicki Bier
Student Paper Award Committee	Joe Hahn & Asa Palley	Emanuele Borgonovo & Joe Hahn

Letter from the Editors

Debarun Bhattacharjya and Cameron MacKenzie

Dear reader,

Happy new year! We hope you are staying warm this winter, particularly if you happen to reside in a colder part of the world. We enjoyed meeting several members of the DAS at the INFORM Annual Meeting, and look forward to an energetic 2018. We would like to congratulate Léa Deleris and Eva Regnier on their Council positions.

We are excited to announce the return of the “Research” column and welcome Roshanak Nateghi as its column editor! First up, Roshanak brings us a column by P. Suresh C. Rao, Elisabeth Krueger, and Christopher J. Klinkhamer on resilient urban infrastructure. We are thankful to Roshanak for helping to organize and edit the Research column.

As part of the newsletter’s regular features, Pat Leach’s “DA Practice” column continues previous musings about how decision analysis could be more widely adopted. In the “Ask DAS” column, Florian Federspiel and Allison Reilly chat with Robin Dillon-Merrill, program director for the National Science Foundation’s (NSF) new Human, Disasters, and the Built Environment (HDBE) program. Mavis Wang and Shijith Kumar in “DA Around the World” received reports about two summer conferences in 2017: The Health Economists’ Study Group’s Summer 2017 Meeting in Scotland and the 24th International Conference on Multiple Criteria Decision Making in Ottawa.

Finally, the newsletter contains abstracts for the most recent issue of the *Decision Analysis* journal (a special issue on decision analysis and social media) and announcements about the SDP annual conference in April. A free SDP webinar will also be hosted on January 17; details are available at:

<http://www.decisionprofessionals.com/events/amntl4fzakeyzt>

We thank all the column editors for their excellent contributions; the newsletter functions primarily due to their efforts. We welcome any suggestions about the newsletter—please feel free to send us a note if you have any ideas and thoughts for future issues.

Happy reading,

Cameron and Debarun

Upcoming Conferences

January 24-26, 2018

The 7th International Conference on Operations
Research and Enterprise Systems
Madeira, Portugal

<http://www.icores.org/>

April 11-13, 2018

Annual Conference of the Society of Decision
Professionals (SDP): Decision Analysis Affinity
Group (DAAG)
Vancouver, Canada

www.decisionprofessionals.com

April 15-17, 2018

2018 INFORMS Conference on Business
Analytics & Operations Research
Baltimore, Maryland, USA

[http://meetings2.informs.org/wordpress/analytics
2018/](http://meetings2.informs.org/wordpress/analytics2018/)

May 4-7, 2018

Production and Operations Management Annual
Conference
Houston, Texas, USA

<https://pomsmeetings.org/conf-2018/>

May 19-22, 2018

Institute for Industrial and Systems Engineers
Annual Conference and Expo
Orlando, Florida, USA

<http://www.iise.org/Annual/default.aspx>

June 17-June 20, 2018

2018 INFORMS International Conference,
Taipei, Taiwan

[http://meetings2.informs.org/wordpress/2018inte
rnational/](http://meetings2.informs.org/wordpress/2018international/)

July 8-11, 2018

29th European Conference on Operational
Research
Valencia, Spain

<http://euro2018valencia.com/>

Aug 6-10, 2018

Conference on Uncertainty in Artificial
Intelligence (UAI)
Monterey, California, USA

<http://www.auai.org/uai2018>

Book Announcement

Luis C. Dias, Alec Morton, John Quigley (Eds.)
Elicitation - The Science and Art of Structuring Judgement
2018, Springer (Series: International Series in Operations Research & Management Science)

This book is about elicitation: the facilitation of the quantitative expression of subjective judgement about matters of fact, interacting with subject experts, or about matters of value, interacting with decision makers or stakeholders. It offers an integrated presentation of procedures and processes that allow analysts and experts to think clearly about numbers, particularly the inputs for decision support systems and models. This presentation encompasses research originating in the communities of structured probability elicitation/calibration and multi-criteria decision analysis, often unaware of each other's developments.

Table of contents:

1. Elicitation: State of the Art and Science - Luis C. Dias, Alec Morton, and John Quigley
2. Elicitation in the Classical Model - John Quigley, Abigail Colson, Willy Aspinall, and Roger M. Cooke
3. Validation in the Classical Model - Roger M. Cooke
4. SHELF: The Sheffield Elicitation Framework - John Paul Gosling
5. IDEA for Uncertainty Quantification - Anca M. Hanea, Mark Burgman, and Victoria Hemming
6. Elicitation and Calibration: A Bayesian Perspective - David Hartley and Simon French
7. A Methodology for Constructing Subjective Probability Distributions with Data - John Quigley and Lesley Walls
8. Eliciting Multivariate Uncertainty from Experts: Considerations and Approaches Along the Expert Judgement - Christoph Werner, Anca M. Hanea, and Oswaldo Morales-Nápoles
9. Combining Judgements from Correlated Experts - Kevin J. Wilson and Malcolm Farrow
10. Utility Elicitation - Jorge González-Ortega, Vesela Radovic, and David Ríos Insua
11. Elicitation in Target-Oriented Utility - Robert F. Bordley
12. Multiattribute Value Elicitation - Alec Morton
13. Disaggregation Approach to Value Elicitation - Nikolaos F. Matsatsinis, Evangelos Grigoroudis, and Eleftherios Siskos

14. Eliciting Multi-Criteria Preferences: ELECTRE Models - Luis C. Dias and Vincent Mousseau
 15. Individual and Group Biases in Value and Uncertainty Judgments - Gilberto Montibeller and Detlof von Winterfeldt
 16. The Selection of Experts for (Probabilistic) Expert Knowledge Elicitation - Fergus Bolger
 17. Eliciting Probabilistic Judgements for Integrating Decision Support Systems - Martine J. Barons, Sophia K. Wright, and Jim Q. Smith
 18. Expert Elicitation to Inform Health Technology Assessment - Marta O. Soares and Laura Bojke
 19. Expert Judgment Based Nuclear Threat Assessment for Vessels Arriving in the - Jason R. W. Merrick and Laura A. Albert
 20. Risk Assessment Using Group Elicitation: Case Study on Start-up of a New Logistics System - Markus Porthin, Tony Rosqvist, and Susanna Kunttu
 21. Group Decision Support for Crop Planning: A Case Study to Guide the Process of Preferences Elicitation - Pavlos Delias, Evangelos Grigoroudis, and Nikolaos F. Matsatsinis
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2017 INFORMS *DAS Awards*

Frank P. Ramsey Medal Award

Prof. Simon French (Applied Statistics and Risk, University of Warwick) has been named as the 2017 Ramsey Medalist. The selection committee included Eric Bickel (Chair), Robin Keller, Jack Kloeber, Greg Parnell, and Carl Spetzler.

Picture: Ramsey Medal Award winner: Simon French (L) and Karen Jenni (R)



DAS Practice Award

The winners of this year's DAS Practice Award are Valentina Ferretti and Gabriella Csányi for work titled: "How to improve educational programs for underprivileged children? The impacts of value-focused Decision Analysis."

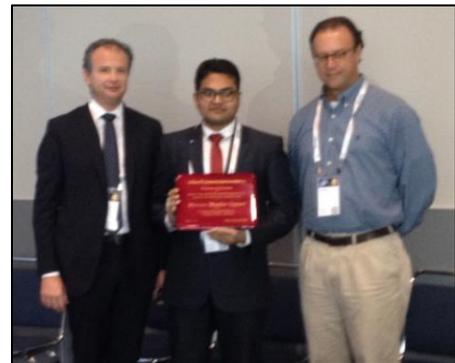
Picture: Practice Award winner: Valentina Ferretti (L), Greg Hamm (C), Gabriella Csányi (R)



DAS Student Paper Award

The winner of this year's student paper award is Bhavani Shanker Uppari, for the paper "Modeling newsvendor behavior: A prospect theory," co-authored with Sameer Hasija. The award selection committee was Emanuele Borgonovo (Co-Chair), Joe Hahn (Co-Chair), Qiushi Chen, Robert Hammond, Gordon Hazen and Canan Ulu.

Picture: Student Paper Award winner: Bhavani Shanker Uppari (C) with Emanuele Borgonovo (L) and Joe Hahn (R)



DAS Publication Award

The winners of this year's publication paper award are Neil Stewart, Stian Reimers and Adam Harris for the paper "On the origin of utility, weighting, and discounting functions: How they get their shapes and how to change their shapes". The award chair was Vicki Bier. [No picture – the speaker was remote.]

Decision Analysis December 2017 Issue

<http://pubsonline.informs.org/toc/deca/14/3>

Special Issue on Decision Analysis and Social Media

Ali E. Abbas, Jay Simon, Chris Smith

Timely Decision Analysis Enabled by Efficient Social Media Modeling

Theodore T. Allen, Zhenhuan Sui, Nathan L. Parker

Abstract. Many decision problems are set in changing environments. For example, determining the optimal investment in cyber maintenance depends on whether there is evidence of an unusual vulnerability, such as “Heartbleed,” that is causing an especially high rate of incidents. This gives rise to the need for timely information to update decision models so that optimal policies can be generated for each decision period. Social media provide a streaming source of relevant information, but that information needs to be efficiently transformed into numbers to enable the needed updates. This article explores the use of social media as an observation source for timely decision making. To efficiently generate the observations for Bayesian updates, we propose a novel computational method to fit an existing clustering model. The proposed method is called k -means latent Dirichlet allocation (KLDA). We illustrate the method using a cybersecurity problem. Many organizations ignore “medium” vulnerabilities identified during periodic scans. Decision makers must choose whether staff should be required to address these vulnerabilities during periods of elevated risk. Also, we study four text corpora with 100 replications and show that KLDA is associated with significantly reduced computational times and more consistent model accuracy.

<https://doi.org/10.1287/deca.2017.0360>

Online and Off the Field: Predicting School Choice in College Football Recruiting from Social Media Data

Kristina Gavin Bigsby, Jeffrey W. Ohlmann, Kang Zhao

Abstract. This study explores predictors of school choice decisions in American college football recruitment. We combine data about individual athletes’ recruiting activities with social media data to predict which school the athlete will choose among those that have offered him a scholarship. While

previous works have approached school choice as a rational decision process, our results indicate that a bounded rationality model incorporating social factors and heuristics may be more appropriate. We explore how the actions taken by athletes during recruitment can be interpreted as early signals of athletes' preferences and find that models incorporating social media features consistently outperform the baseline model with only off-line recruiting features. In addition to better understanding the school choice decision, this work can help coaches to effectively allocate recruiting resources and inform social media strategies during recruitment.

<https://doi.org/10.1287/deca.2017.0353>

Identifying Soccer Players on Facebook Through Predictive Analytics

Matthias Bogaert, Michel Ballings, Martijn Hosten, Dirk Van den Poel

Abstract. This study assesses the feasibility of identifying self-reported sports practitioners (soccer players) on Facebook. The main goal is to develop a system to support marketers with the decision as to which prospects to target for advertising purposes. To do so, we benchmark several algorithms (i.e., random forest, logistic regression, adaboost, rotation forest, neural networks, and kernel factory) using five times twofold cross-validation. To evaluate performance and variable importances, we build a fusion model, which combines the results of the other algorithms using the weighted average. This technique is also referred to as information-fusion sensitivity analysis. The results reveal that Facebook data provide a viable basis to come up with sports predictions as the predictive performance ranges from 72.01% to 80.43% for area under the receiver operating characteristic curve (AUC), from 81.96% to 83.95% for accuracy, and from 2.41 to 3.06 for top-decile lift. Our benchmark study indicates that stochastic adaboost, the fusion model, random forest, rotation forest, and regularized logistic regression are the best-performing algorithms. Furthermore, the results show that the most important variables are the *average number of friends that play soccer*, *membership of a soccer group*, and the *number of favorite teams*. We also assess the impact of our results on profitability by conducting a thorough sensitivity analysis. Our analysis reveals that our approach can be beneficial for a wide range of companies. The analysis and results in this study will assist sports brands with decisions regarding their implementation of targeted marketing approaches.

<https://doi.org/10.1287/deca.2017.0354>

Social Media Analytics: Literature Review and Directions for Future Research

Ashish K. Rathore, Arpan K. Kar, P. Vigneswara Ilavarasan

Abstract. Businesses are currently using social media analytics (SMA) to develop insights for improving performance and productivity across different functions. The SMA knowledge is growing diversely, and there is a need to understand the trends and approaches holistically. The present paper offers a comprehensive review of the SMA empirical literature and directions for future research. The review is based on 54 papers selected out of 843 search results. The review focuses on different domains: industrial domains, data-mining objectives, use cases, and applications. Out of the studies, public administration and consumer discretionary sectors are the dominant ones with Twitter data being used in most of the analysis. Out of the possible techniques, classification techniques and regression models are more popular than others. Stakeholder engagement is the most focused theme in the research studies. The review also offers insights into which analytical approaches are being used in which industrial domains for specific decision making. It further suggests that novel methods, such as cross-media data classification, tags detection, label priority ranking, tweeting activity signatures, and geospatial data processing have been used less and could be further explored in future research. The review also offers implications for the decision sciences domain.

<https://doi.org/10.1287/deca.2017.0355>

- **DECA Blog**

Be sure to check out the *Decision Analysis* journal blog: **Decision Analysis Review** at <https://www.informs.org/IOL-Home/Blogs/DECA-Blogs/DECA-Review>

Attention INFORMS Decision Analysis Society Members!

By special arrangement with the Decision Analysis Society Council,
dues-paying regular members of the DAS receive a
subscription to the journal as part of their membership dues.

The DAS is a subdivision of INFORMS.
For information on DAS: <https://www.informs.org/Community/DAS> .

Decision Analysis is a quarterly journal dedicated to advancing the theory, application, and teaching of all aspects of decision analysis. The primary focus of the journal is to develop and study operational decision-making methods, drawing on all aspects of decision theory and decision analysis, with the ultimate objective of providing practical guidance for decision makers. As such, the journal aims to bridge the theory and practice of decision analysis, facilitating communication and the exchange of knowledge among decision analysts in academia, business, industry, and government. *Decision Analysis* is published in March, June, September, and December by the Institute for Operations Research and the Management Sciences (INFORMS) at 5521 Research Park Drive, Suite 200, Catonsville, Maryland 21228. Please visit our website at <http://pubsonline.informs.org/journal/deca>.

DA Around the World

Column Editors: Chen (Mavis) Wang and Shijith Kumar



In this column we introduce different kinds of Decision Analysis communities around the world with the purpose of promoting their visibility and strengthening the ties between DA researchers and practitioners across borders. In the current issue we would like to introduce two conferences that took place outside the US in the summer of 2017. The Health Economists' Study Group's Summer 2017 Meeting was held by the Health Economics Research Unit at University of Aberdeen in Scotland from June 28-30. And the 24th International Conference on Multiple Criteria Decision Making was hosted by the Telfer School of Management at University of Ottawa from July 10-14, with the theme of "Creating a Sustainable Society." We are very excited to receive two wonderful reports from the conference organizers. Enjoy!

Health Economists' Study Group Summer 2017 Meeting

Contributed by: Dr. Ourega-Zoé Ejebu
Health Economics Research Unit
University of Aberdeen

The Health Economists' Study Group (HESG) is a UK-based group existing to support and promote the work of health economists. It was founded in 1972 and is the oldest organization of its type in health economics and remains one of the largest. The group organizes two HESG meetings per year at which academic and policy relevant papers are discussed.

This summer, the Health Economics Research Unit (HERU) was delighted to host a 3-day bi-annual HESG Conference which commenced from Wednesday the 28th to Friday the 30th of June 2017. The conference took place at the King's College Centre located in Old Aberdeen, Aberdeen city (Scotland). This 3-day conference was a great opportunity for Health Economists to gather and share their ongoing research as well as collaborate on other levels of interests. HESG is quite peculiar and unique in its delivery format. Papers are discussed by a discussant rather than by its author(s), making it an interesting concept and feedback channel between authors and discussants alike. The event also showcased PhD students and Early Career Researchers who viewed this as a favorable and good opportunity to promote and support their research development.

The event was well attended with over 100 delegates from a wide range of UK and international Universities across the globe. The conference brought together delegates from York, Glasgow,

Manchester, Sheffield, and from across France, Italy, Canada, and Australia among others. Participation from HERU personnel was also very evident and well received. The 3-day conference included a series of diverse and excellent presentations, ranging from Health Behavior, Financing Health Systems, Stated Preferences, and Economic Evaluation.

Day 1 kicked off with parallel sessions which runs concurrently throughout the event to encourage knowledge transfer and ideas sharing. In addition, Day 2 included a plenary session about the History of Health Economics with Professors Sally Sheard and Anne Ludbrook. The plenary session gave an interesting historical perspective of the beginning of Health Economics which started with the “concern of NHS expenditure in 1948.” Professor Sally Sheard reminded us of the pioneer centers in Health Economics, (Aberdeen, York, Brunel, and London School of Economics (LSE)), the need for Health Economists to work alongside policy makers and convince them of the usefulness and practicalities of Health Economics in our modern-day society and in the future. The plenary session stirred up interesting food for thought discussions from the floor as well as constructive feedbacks from the audience. Delegates were also given a taste of Scotland at the end of Day 2, which concluded with a conference dinner at the Norwood Hotel.

Day 3 featured a small group of delegates who participated in a historical tour of Old Aberdeen as well as a little taste of the (rainy) weather as expected from the old Granite City. The HESG conference ended on a high note with discussions, ideas, and contributions from discussants and authors by promoting collaboration amongst participants and sharing of ideas across all levels. It was a privilege and wonderful experience for HERU to host another very friendly and beneficial HESG Conference.





The 24th International Conference on Multiple Criteria Decision Making



Dear colleagues and friends,

I am very pleased to share with you our report for the MCDM 2017 conference. It was a memorable gathering for many of us. Enjoy and I hope to see you in our forthcoming events.

Sincerely,

Sarah Ben Amor, General Conference Chair

Associate Professor, Telfer School of Management, University of Ottawa

The 24th edition of the International Conference on Multiple Criteria Decision Making (MCDM 2017) was held at the Telfer School of Management, University of Ottawa from July 10-14, 2017.

It has been over ten years now that the last MCDM international conference was held in Canada, in Whistler in 2004. This year, the conference gathered 200 participants plus 7 accompanying persons from 27 countries. More than 60 participants were students and 12 participants were from Industries.

The conference had a topical theme: Creating a Sustainable Society. The call for papers, designed to encourage contributions that highlight the latest application of MCDM tools to sustainable management challenges, was largely answered.

The scientific program included 173 talks and 10 poster presentations. A total number of 173 talks and 10 poster presentations have been scheduled in 4 parallel sessions. Eighty-seven talks, including the 10 posters, were in contributed sessions, the remainder were distributed among 19 invited sessions. Also in the program were nine special sessions that include the opening and closing sessions, the four plenary addresses, the doctoral dissertation session, the awards session, and the business meeting.

The four plenary talks were delivered by

- Blair Feltmate of the Intact Centre on Climate Adaptation at the University of Waterloo: Un-Natural Alliances: Financial and Ecological Expertise Must Align to Address the Contagion of Climate Change,
- Jyrki Wallenius from the Aalto University School of Business: A Voting Advice Model and Its Application to Parliamentary Elections in Finland
- Tuure Tuunanen from the University of Jyväskylä: Design Science Research: Theory Ingrained Artifact and Deriving Theories from Artifact, and
- Jack Kitts, President and Chief Executive Office of the Ottawa Hospital: Is it possible to create a sustainable healthcare system in Canada?



Blair Feltmate, Jyrki Wallenius, Tuure Tuunanen and Jack Kitts

The conference organization granted free registration to 6 senior participants (Telfer Professors), 6 students, 3 finalists, 3 speakers and all local students. The organization also provided 5 participants with free accommodation.

In addition to the rich scientific program, we offered a full slate of social events in line with the traditions of the Society. On Sunday evening the get-together took place in the Tabaret Hall, the oldest and most

prestigious building of the University of Ottawa. The participants could enjoy some drinks, fine bites and a wonderful piano playing. For the half-day outing, an afternoon cruise was organized along the Ottawa River taking in the sights upon The Ottawa River Queen, refurbished in the style of an early 19th century paddle steamer. During the cruise, a buffet dinner was served in a warm and friendly atmosphere.



Outing on the Ottawa River

The conference banquet was held at the historical Chateau Laurier Hotel in one of its most elegant rooms. A five-course menu was concocted for the occasion by one of the best chefs of the region using finest local products. The Cowguys performing group offered a delightful surprise to the audience with their talented and engaging show. After dinner, next door to the hotel, participants joined the lawn of the Parliament Buildings for the Sound and light show on Parliament Hill. They enjoyed an artistic overview of the history of Canada in a special year where the country is celebrating its 150th birthday.



The Cowguys performing

During the conference dinner, the Awards of the Society were announced. The awardees were:

- Georg Cantor Award: Kaisa Miettinen, University of Jyväskylä, Finland.
- Edgeworth-Pareto Award: Wojtek Michalowski, Telfer School of Management, University of Ottawa, Canada.
- MCDM Gold Medal: José Rui Figueira, IST, University of Lisbon, Portugal.



Theo Stewart, José Rui Figueira, Sarah Ben Amor, Murat Köksalan, Wojtek Michalowski and Kaisa Miettinen

The three awardees delivered their talks during a plenary session on Friday morning. Besides, three finalists of the MCDM doctoral dissertation award competition gave a brief talk and the MCDM Doctoral Dissertation Award was for Britta Schultze, University of Wuppertal, Germany.

Finally, I would like to remind all members of the Society that the opportunity is given to submit full papers presented at the conference (but not limited to) to the following special issues and special volume:

- Special Issue on **Theory and Applications of Fuzzy Systems and Multicriteria Decision Analysis**, in *Advances in Fuzzy Systems*, edited by Antonella Petrillo, Fabio De Felice, Alessio Ishizaka.
- Special Issue on **Multi-Criteria Decision Making for Sustainable Decisions**, in *Annals of Operations Research*, edited by Sarah Ben Amor, Anissa Frini and Gilles Reinhardt.



Jyrki Wallenius, Britta Schultze, Sarah Ben Amor, Murat Köksalan and Giovanni Palmisano

- A special volume for the stream of invited “AS” sessions: “**Advanced Studies in MCDM**”, CRC Press, edited by Sarah Ben Amor, Adiel Teixeira de Almeida, João Miranda, Emel Aktas. The topics covered in the stream are:
 - AS1) Decision Aiding/Making in the World of Today
 - AS2) Collaboration and Interaction of MCDM with Other Sciences
 - AS3) Innovative Decision Aiding For Industries
 - AS4) Decision Support for Services Systems and Companies
 - AS5) Prospects and Future Challenges on MCDA/M
- Special Issue on **Feature Issue on Interactive Multiple Criteria Decision Making**, in European Journal for Decision Processes, edited by Murat Köksalan and Gülşah Karakaya.
- Special Issue on **Multi-objective Combinatorial Optimization**, in International Journal of Information Technology & Decision Making, edited by Murat Köksalan and Banu Lokman.
- Special Issue on **New Methodological and Practical Developments of the PROMETHEE Methods**, in International Journal of Multicriteria Decision Making, edited by Alessio Ishizaka and Salem Chakhar.
- Special Issue on **Outsourcing and Offshoring Decision Making**, in International Journal of Production Research, edited by Alessio Ishizaka, Arijit Bhattacharya, Angappa Gunasekaran, Rob Dekkers.

- Special Issue on **MCDA Practice**, in the Journal of Multi-Criteria Decision Analysis, edited by Johannes Siebert, Jana Krejčí, and Theodor Stewart.
- Special Issue on **Multi-Criteria Decision Making in Health Care**, in Operations Research for Health Care, edited by Melanie Reuter-Oppermann, Sebastian Rachuba, Andrea Raith.
- Special Issue on **Global Optimization with Multiple Criteria: Theory, Methods and Applications**, in Journal of Global Optimization, edited by Francisco Ruiz, Carlos, Kaisa Miettinen.
- Special Issue on **Theoretical and empirical research, real-world applications, case studies and MCDM software**, in Multiple Criteria Decision Making, edited by Tadeusz Trzaskalik.

The call for papers and submission deadlines are announced on the conference website:

<http://sites.telfer.uottawa.ca/mcdm2017/publications/>.

Organizing such a conference would not have been possible without the help of many people and organizations. As the general chair of the conference, I would like to warmly thank all the people who have made this conference possible: the program committee (chaired by Prof. Francisco Ruiz and by Prof. Gilles Reinhardt locally), the organizers of the invited sessions, the plenary speakers, the chairpersons, and all the presenters and authors of communications. Also, thank you to the different committees that worked hard before and during the conference: the MCDM Society Executive Committee (chaired by Murat Koksalan), the MCDM Awards Committee (chaired by Theo Stewart) and the Doctoral Dissertation Award Committee (chaired by Jyrki Wallenius). I would like to close by expressing my deepest gratitude first to our main sponsors: the International Society on MCDM, the University of Ottawa and the Telfer School of Management; second to my Telfer colleagues, especially Wojtek Michalowski, Gilles Reinhardt and Susan Redmond, and finally to our wonderful students for their tremendous efforts and full support.

Sarah Ben Amor
General Chair

DA Practice

Column Editor: Pat Leach



Further Considering Decision Analysis

In the Spring 2017 issue, I wrote about a few potential reasons why Decision Analysis has not been adopted as universally as, say, Six Sigma or Continuous Quality Improvement has. I'd like to expand on that topic here.

Part of the problem is that far too many practitioners of decision analysis have too narrow a view of the decision process. We often tend to think of it as a series of steps that, if done well, will lead to an excellent decision. This is usually true in what Dave Snowden calls "Complicated" situations, but requires more nuance and flexibility in other situations.

DA should be a "process" only in the loosest sense of the word. It is a process in that there is a series of *objectives* (not steps) that are common to finding a good strategy or making a good decision in a difficult situation. You want to understand the situation clearly; you need clarity around your objectives, and the tradeoffs between competing objectives; you want to think creatively about potential alternative solutions; you want to collect information pertinent to making the decision; you want to grasp the range of possible outcomes associated with each potential solution, and the factors that drive those ranges; you want to consider the human factors associated with implementing any strategy or initiative; and you want to preserve as much flexibility as possible to change course in the future, should circumstances change. How we actually go about achieving these objectives—which tools we use, which objectives are given priority—can and should vary greatly from case to case. Often, it doesn't; it becomes a cookbook. I believe this has hindered the spread of DA.

The first distinction I would make is between data-driven decisions vs. data-seeking decisions. In data-driven situations, a detailed understanding of the immediate situation (and what led up to it) drives the decision. This is the realm of Big Data or Best Practices, where gathering and analyzing large amounts of data will reveal key insights crucial to the decision. Mr. Snowden presented an excellent example of this at the DAAG 2015 conference when he spoke about the work he has done with the U.S. military in Afghanistan. In such a case, decisions are driven by current situation on the ground. The more data you have, the better your decision is likely to be.

In data-seeking situations, we recognize that the world is dynamic and complex, ever-changing. Since we can only collect data from the past or present, it is unlikely to be sufficient when planning for the future. Data-seeking situations usually fall into one of three categories (according to Mr. Snowden's Cynefin framework): Complicated, Complex, and Chaotic. Fortunately, Chaotic situations are relatively rare, so I will focus on the distinction between Complicated and Complex.

In a Complicated situation, we have a good understanding of how things work and what the key parameters are; we just don't know what values those parameters will take in the uncertain future. This is the realm of known unknowns, and it lends itself beautifully to the kind of probabilistic modeling and forecasting that permeates decision analysis. This is where the current practice of DA shines.

Unfortunately, most of the biggest problems facing the world today are not Complicated; they are Complex, in the literal, mathematical sense of the word. Complex Adaptive Systems include ecosystems, biological systems, economic systems, the atmosphere, the oceans, and just about every aspect of the real world around us. We often do not even understand all of the factors involved in determining a Complex system's behavior. The system affects the behavior of the individual agents or elements within it, and those agents or elements in turn affect the behaviors of other agents or elements, as well as that of the system itself. Iterative feedback loops abound, resulting in phenomena like the "butterfly effect," "strange attractors," and "tipping points." Tiny differences in starting conditions can result in drastically different outcomes. A Complex system will remain in a dynamic, steady state for an extended period of time, only to spiral quite suddenly into a completely different dynamic, steady state. Push a Complex system past a tipping point, and there is no turning back.

The standard, cookbook approach to DA will not work in a Complex situation. The series of objectives associated with the decision process may remain the same, but the tools and the approach must change. Probabilistic forecasting may be helpful, but it will be insufficient. Mr. Snowden says we must probe—we need to prod the system, see how it reacts, and adjust our plans accordingly. We need to pilot various possible solutions, fully expect many of them to fail, and expand those that show promise. The final objective in the decision process series ("preserve as much flexibility as possible to change course in the future") dominates. Rather than try to find the best strategy or decision, our mission is to find a manageable number of promising strategies to test.

Even though Complex situations are not data-driven, Big Data once again may have a major role to play. Having a detailed understanding of the current situation is often crucial to ascertaining which potential solutions to try, which experiments to run.

Decision Analysis as a concept, as a field of study, should encompass all of these approaches to making decisions and developing strategies. It should incorporate tools like game theory, agent-based modeling,

and free-to-fail experimentation. Too often, it does not (or at least, it is not presented as such). Too often, we shoehorn the problem into the approach with which we are most comfortable. We treat Decisions-Made-By-Others as Uncertainties, because we know how to model Uncertainties. We treat Complex situations as though they were Complicated, running probabilistic models in the face of dynamic, iterative systems that behave in ways that cannot be appropriately characterized by a Monte Carlo simulation.

The bad news is that these practices have (I believe) limited the uptake of DA by industries and organizations. The good news is, we can change this. We can broaden our horizons to include a greater array of tools, approaches, and ways of thinking about difficult, complex problems.

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Also for the first time, there will be two parallel tracks during the conference itself for one half-day, on the afternoon of Thursday, the 12th. This will include a session specifically tailored for those who are relatively new to DA.

DAAG 2018 full Program may be found [here](#).

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Creating Value from Uncertainty and Flexibility

17 January, 2018 | 8:00 am PT / 11:00 am ET

Speaker: Reidar Bratvold, University of Stavanger

Moderator: Pat Leach, Independent Strategic Consultant

We invite you to join us for the SDP monthly webinar series. The next presentation will feature Reidar Bratvold in a webinar titled *“Creating Value from Uncertainty and Flexibility”*.

Abstract: Although an increasing number of companies use decision & risk management methods to deal with complex and uncertain decisions, they still get consistent under-performance in typical business metrics leading to less value than expected, or, more perniciously, than possible. Uncertainty per se is not the culprit, rather a failure to make the best decisions under uncertainty—which are often non-intuitive. The real value-destroyers are biases and failing to plan for, and exploit, the different ways reality might evolve - if you under-estimate uncertainty, you are likely to under-invest in managing its consequences. Making the best decisions requires an accurate assessment of uncertainty (unbiased, neither optimistic nor pessimistic) – and an unbiased approach to managing its consequences—putting as much effort on capturing upside opportunities as mitigating risks.

In contrast to the approaches that focus on risk management, the approach discussed in this webinar brings an optimistic view to uncertainty. While there is no doubt that uncertainty can create losses, uncertainty can also be exploited by augmenting the upside and reducing the downside risks inherent in investments.

To register and to read more about the presentation and the speakers' biographies, please visit the Society's website at <http://www.decisionprofessionals.com/events/amntl4fzakeyzt>

Research



Column Editor: Roshanak Nateghi

Resilient Urban Infrastructure?

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Widespread devastation and attempts at recovery, a humanitarian crisis still unfolding along the tracks of three hurricanes (Harvey, Irma, and Maria), have revealed several important features about community resilience, and raised questions about the role of infrastructure networks, especially in extreme events. Emergency response and recovery efforts rightfully focus on rebuilding the damaged infrastructure to restore critical services. Yet, by failing to also address changes needed in management structures, decision making, and policy instruments that serve as disincentives for change, restoring infrastructure addresses only a part of the recovery to enhance community resilience. How do we then assess the resilience of infrastructure networks and coupled socio-economic systems in these affected communities, and develop decision tools for enhancing urban resilience? We will argue here that technological systems in isolation do not have *inherent resilience*. On the contrary, technological systems are imbued with resilience by coupling with socio-economic systems (institutions), which build, maintain, and repair such systems to provide several critical services.

Let us start with the definitions of resilience of complex systems. We have argued (Park et al., 2013) that resilience is not about what a system/network *has* (a list of attributes; all nouns) but rather what it *does* (all verbs) in response to small or large disturbances. In this sense, fail-safe designs of robust infrastructure networks, informed by risk analyses, lead to increased hardening to offer resistance up to a designed level of stress with known probabilities of occurrence. When external stresses exceed such built-in resistance, or arrive as a “surprise” (unexpected from risk analyses), robust infrastructure often fails with catastrophic consequences; levee failures in New Orleans and overtopped sea walls in Tohoku are classic examples. Such robust systems also have designed redundancy and some flexibility to minimize loss of critical services. However, such robust technological systems do not recover without the intervention of public and private institutions that manage them (e.g., utilities, agencies, etc.) and in extreme cases through collective action within the affected communities.

Ability to marshal financial resources, emergency supplies, technological prowess, coordination among government agencies and utilities are all crucial elements of recovery. Building urban resilience requires tightly coupled technological and socio-economic networks. Washed away bridges, eroded and blocked roads, blown substations, or downed power lines and cell towers, etc., do not self-repair. Thus, infrastructure systems in isolation do not have *inherent resilience* to recover. What resilience the

infrastructure exhibit is instead endowed by the adaptive capacity of the social-economic systems that depend on the critical services. The ability to *self-organize* in response to crisis is what complex socio-economic systems (and ecosystems) reveals their resilience. Resilience is then an *emergent property* of coupled complex systems/networks and ecosystems.

Along the tracks of the three hurricanes, poorer and isolated communities experienced more severe damages, have limited adaptive capacity because of the confluence of many limiting factors, and will have longer recovery times. In urban communities, we strive to return to the pre-disaster, desirable state (in a normative sense). However, post-Katrina evolution in New Orleans shows that urban recovery trajectories might lead to social transformations, evident in demographic shifts in the city population, persistence of economic and social inequalities and differential rates of recovery in different parts of the city.

Resilience is not only the ability to recover from a single, large disturbance. As the Japanese saying goes “*Nana korobi, yaoki*” (“fall seven times; get up eight times”), resilience is about being prepared for surprises. Long-term persistence in recovering from loss of functions caused by a series of unexpected disturbances is an essential feature. Resilience is also about recovering from a series of chronic, high probability, and low magnitude events, which gradually erode the adaptive capacity of the affected communities, and leads to collapse even in the absence of an extreme event (Klammler et al., 2017).

Resilience is contingent on *memory* of past events, which defines the current state of the system of interest. The relationship between the recurrence period of disturbance events and the social memory of such disturbances determines the preparedness of the affected community. Because the return period of extreme events is large, social memory of lessons learned from such events has to be equally long (inter-generational). On the other hand, because return periods for frequently recurring events are small, the communities are already well adapted to them. However, non-stationarity of disturbances, with changes in the magnitude and frequency probabilities of extreme events, as illustrated by three successive 1 in 500 year floods in Texas or three back-to-back magnitude-4 hurricanes, pose serious challenges to the resilience of affected urban communities.

The challenge then is to measure/monitor adaptive capacity and to manage it in three ways. First, maintain *total* adaptive capacity above some critical level, both at the scale of the individual within the community and at the city scale. This is similar to accumulating total financial assets (say savings account) to ensure economic security. Second, maintain a certain level of *active* adaptive capacity (e.g., accessible cash flow, similar to not overdrawing a checking account). Third, discourage maladaptive practices that erode adaptive capacity or inhibit emergence of resilience.

In the current crisis in Puerto Rico, delivering essential supplies where most needed is limited by logistical challenges from collapse of transport, communication and power infrastructure networks in Puerto Rico (constrained adaptive capacity). The communities coping with such a dire situation for extended periods have to depend on self-help at a neighborhood scale. As admirably demonstrated in Houston, Florida, and Puerto Rico, self-organized large-scale mobilization of resources helped affected communities to survive the aftermath of the hurricanes.

Resilience of communities depends on multiple infrastructure systems/networks that are geospatially co-located and functionally inter-dependent. These networks co-evolve over time as cities grow and as the demands change, and the complexity of inter-dependence increases. For example, failure of power grids

leads to problems in treating and pumping potable water through distribution networks, traffic jams from loss of traffic signals and other traffic management systems, loss of communication networks, and inability to provide critical medical assistance. Again, in Puerto Rico, such cascading failures have severely limited the communities' ability to cope and recover from the hurricanes.

We proposed (Park et al., 2013) that resilience of complex systems is also a *recursive process*. The Adaptive Cycle for resilience in coupled social and technological systems comprises of four essential steps. *Sensing* requires monitoring of the system states (e.g., Big Data) for diagnosing shortcomings.

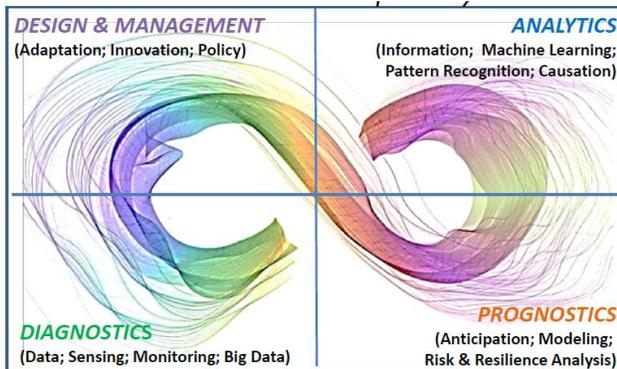


Figure 1. Resilience as a recursive process. Möbius strip image from: <https://gizmo.com/tag/mobius-strip>

"Sensing" does not eliminate variability, instead it increases awareness of *people* to changes to their environment. *Learning*, based on analysis of monitoring data and other related information (e.g., machine learning and other analytical tools), allows recognition of spatial and temporal patterns. A part of "learning" is maintaining community memory of past events and lessons learned from events that had occurred in different places.

Anticipating, based on data-model integration, helps develop forecasting ability of impending vulnerabilities. Communities fine-tuned to long-term variations develop appropriate adaptive strategies, but

are not well prepared to deal with surprises (stochastic shocks). For extreme events like hurricanes, sophisticated monitoring and advanced models do provide few days of lead-time for preparation. Failure to predict the erratic trajectories of the Hurricanes Harvey and Irma show how even sophisticated models are unable to predict the outcomes of feedbacks on large-scale behavior of complex systems. However, large events like earthquakes and tsunamis or flash floods require quick response if robust infrastructure fails.

Adapting is needed for maintaining a desirable regime, by coping with disturbances and improving system elements, such as design and management practices, or by transforming system structures (e.g., network topology and flows) in order to maintain and improve functions. Anticipation and adaptation also determine the preparedness of the communities. Kreibich et al (2017) examined impacts of successive floods, and found that the damage from the second flood event was significantly lower. Increase in awareness (learning), better preparedness (anticipation), and improved emergency response (management) all contributed to effective reduction in flood vulnerabilities and facilitated adaptation. Based on analyses (data analytics) multiple case studies, they argue for a shift from reactive to anticipatory flood risk management.

Our recent work (Krueger et al., 2017; Klinkhamer et al., 2017; Yang et al., 2017; Zischg et al., 2017) on urban water infrastructure networks in several cities shows that in spite of the obvious differences in structure (layouts of pipe, road, and river networks) among these urban networks, their functional topologies based on flows have striking similarities. These results are in agreement with analyses of internet and neural networks. With increasing size, as the population and demands grow, the network functional topology converges to become increasingly self-similar. That is, neighborhood variations in

infrastructure networks reflect local constraints and engineering design requirements, but larger, city-scale features overwhelm such differences, and urban network topology is surprisingly similar to naturally evolved networks (e.g., rivers). Where deviations from this "natural design" occur, operational difficulties are likely in managing infrastructure networks. We should learn from these observations that while engineered systems allow maintaining certain desired functions, natural systems provide blueprints of how to approach engineering design. Cities are integral components of regional, national, global networks of other cities; as such, resilience of any one city has significant implications to many other cities embedded in the network.

Large cities that build and operate large, complex, interdependent infrastructure networks also develop sophisticated socio-economic networks to maintain and manage the delivery of crucial services to urban citizens. Reliable functioning of these infrastructure networks contributes to their "invisibility." Only failure reveals their inadequacies. In such cities, the user community is largely not engaged in the operations of infrastructure. In fast-developing countries, the existing aging infrastructure is overwhelmed by rapid growth in demands, the lack of coordination among agencies, and limited financial resources to maintain and upgrade. Given such limitations of infrastructure and dysfunctional institutions, household- and community-level adaptive strategies help cope with limited services, and inadequate access to infrastructure.

Like in the case of the recent hurricanes, poorer communities have a lower ability to cope and adapt, restrained by multiple limiting factors, such as the lack of financial capital and access to infrastructure and services. Such examples reveal how inter-dependence between infrastructure and socio-economic systems contributes to or erodes community resilience. Just as there are differences among cities in their adaptive capacity for maintaining resilience, there are similar differences within communities in a city. This contributes to inequities in the ability of communities to cope with extreme events, and contributes to persistent patterns of unequal spatial resilience within and among cities. In Puerto Rico, recovering slowly from the ravages of Hurricane Maria, only ~30% of the population has power (unlikely to meet the promised 90% recovery by end of the year), and 70% have water but must boil to drink. However, economic inequalities that existed before Maria were exacerbated and evident in the great disparities in the recovery of different communities.

Resilience of coupled technological-engineered systems/networks is also about avoiding "traps". Significant limitations of resources (i.e., adaptive capacity) to cope with and upgrade infrastructure and improve institutions drives some communities into "Poverty Traps" where provision of critical services is inadequate, unreliable, and/or access is limited. Without help from external agencies, these communities cannot recover. The other extreme is a "Rigidity Trap", where the sunk costs of robust-yet-fragile infrastructure are large enough to scuttle efforts in reducing vulnerabilities from extreme events. Increasing adaptive capacity and improved access to infrastructure are essential to escape from poverty traps. Instead of hardening infrastructure to be robust, introducing flexibility, diversity, and some decentralization of infrastructure helps avoid rigidity traps. In socio-ecological systems, increased robustness to decrease system state variance works in the short-term, but builds up hidden vulnerabilities and can lead to catastrophic failures (Ishtiaque et al., 2017). Such trade-offs must be carefully evaluated in technological-social systems as well. Improved social connectivity and broader engagement in governance enhances overall community resilience.

Lack of methodical knowledge and integrated modeling of loss/recovery of critical services derived from coupled engineered and social systems, and failure to maintain appropriate interdependencies between these coupled urban systems - especially for coping with chronic and extreme events - can have serious consequences. Examples include failure to maintain adequate adaptive capacity, poor understanding of the recovery process, misallocation of resources; longer recovery times for physical networks and communities, high recovery costs, incremental degradation of system functioning, and misguided policy-making. A recent National Academy Workshop Report (NRC, 2015) concluded that the US does not “currently have a consistent basis for measuring [community] resilience” that includes infrastructure and institutional interdependencies, and as such “making it difficult for communities to monitor improvements or changes in their resilience.” The report also emphasizes the need to work with communities and urban managers to identify decision tools and strategies for implementing resilience enhancing approaches.

Complete destruction of the power grid in Puerto Rico gives the reconstruction planners and decision makers the opportunity to consider how best to spend the millions of dollars allocated for reconstruction. Should we rebuild the power-grid back with above ground power lines that are vulnerable for future hurricanes, or to put new power lines below ground? Similarly, should the water supply infrastructure be somewhat decentralized at least for remote and rural locations? How do we alter the regulatory and economic disincentives that encourage counter-productive recovery paths (e.g., insurance support to rebuild in vulnerable areas; further hardening of infrastructure; funding policies for disaster relief)?

The communities ravaged by the hurricanes have an opportunity to restore and rebuild their infrastructure by not returning to pre-hurricane technological systems (perhaps even more hardening); rather, some optimal combination of risk-based resistance and resilience approaches will decrease their vulnerabilities to future disruptions. Restored infrastructure must enable communities to better use and amplify their adaptive capacity. In addition, maintaining the numerous ecosystem services provided by natural systems (see Costanza et al., 2017) is a prerequisite to community resilience, and must not be compromised by a singular focus on either social or technological systems in isolation. Resources needed for urban prosperity and resilience are drawn from distant sources, and urban flows do have adverse impacts on resources at these locations. Cities are integral components of regional, national, global networks of other cities; as such, resilience of any one city has significant implications to many other cities embedded in the network.

Many initiatives around the world exist to make cities resilient, such as the “100 Resilient Cities” initiative (Rockefeller, 2016), the London School of Economics Cities project (LSE, 2016), the C40 Cities (C40, 2016), ICLEI Resilient Cities (ICLEI, 2016), among many others. These initiatives show the urgency and global efforts to develop and operationalize urban resilience (e.g., NRC 2015). However, these projects are currently striving to develop tangible criteria, such as developing urban resilience indices for making cities resilient. Yet, delivering methods to measure and model urban resilience remains a challenge. Operationalizing resilience strategies and developing consistent policy/regulatory frameworks are also challenges (Linkov et al. 2015). It is important to understand how cities can be highly adaptive and resilient in order to maintain essential functions (i.e., demands for critical services are met) even when confronted by catastrophic disasters and multiple changes (de Perez et al., 2015).

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Ask DAS



Column Editors: Florian Federspiel and Allison Reilly

Funding Opportunities at NSF: The Human, Disasters, and the Built Environment Program

For this edition of Ask DAS, we had the exciting opportunity to speak with Dr. Robin Dillon-Merrill about her role as program director for the National Science Foundation's (NSF) new Human, Disasters, and the Built Environment (HDBE) program. We're sharing an excerpt of our conversation below. You can contact Robin Dillon-Merrill at rdillonm@nsf.gov



To start us off, please describe the objectives of the HDBE program, and for those familiar with NSF's former Infrastructure Management and Extreme Events (IMEE) program, how does HDBE differ from the IMEE?

The official NSF description of this funding opportunity is:

“The HDBE program supports fundamental, multidisciplinary research on the interactions between humans and the built environment within and among communities exposed to natural, technological and other types of hazards and disasters. The program focuses on ongoing and emerging changes in three interwoven elements of a community: its population, its built environment (including critical infrastructure, physical and virtual spaces, and buildings and related structures) and the hazards and disasters to which the community is exposed. The HDBE program seeks to support research that integrates these elements and that can contribute to theories that hold over a broad range of scales and conditions. Examples include but are not limited to unified frameworks and theoretical models that encompass non-hazard to extreme hazard and disaster conditions, theoretical and empirical studies that consider how interactions between a community's population and its built environment may suppress or amplify hazard exposure or its effects, and studies that seek to inform scholarship through the development of shared data and related resources. In these and other areas funded through the HDBE program, research that challenges conventional wisdom on the interactions among humans, the built environment and hazards and disasters is particularly encouraged. Given the richness of the phenomena under study, the HDBE program seeks research that advances theories, methods and data within and across diverse disciplines, whether in engineering, the social sciences, computing or other relevant fields. Ultimately, research funded through this program is expected to inform how communities can cultivate and engage a broad range of physical, social and other resources to ensure improved quality of life for their inhabitants.”

While the HDBE program is still closely related to the former IMEE program, the name was changed to reflect a strengthened emphasis on the social and behavioral component. The people component needs to be a critical part of any proposal. Previously, I think it was implicit that a social or behavioral component was needed, but it was not necessarily obvious to everyone. For instance, we're not merely interested in investigating damage caused by flooding to a bridge, (i.e., an extreme event affecting an infrastructure). There needs to be a research component that considers the role of people in the system.

How do you see decision analysts contributing to the program's research mission?

I think there are many different ways to incorporate the human perspective, with one obvious way to do so being through the decision-making process. Decision makers, for instance emergency managers, are a particular stakeholder group that have to make a lot of critical decisions. Understanding people's evacuation and preparedness decisions and helping them to make better decisions in this context is key. While there are other ways to incorporate social or behavioral aspects, an interesting way would be through the decision-making process.

The objectives of HDBE are broad, could you provide an example of a project that falls outside of the scope of HDBE?

Any project that doesn't address all three components, humans, disasters and the built environment, would fall outside of our scope. For instance, if a project is solely related to individuals and a trauma component, e.g., post-dramatic stress. The same goes for missing the people component. Essentially, all three components have to be clearly integrated in the project or proposal.

Could you share possible do's and don'ts regarding proposal submissions? What might be typical mistakes or shortcomings?

One thing that's a definite must is to contact program managers and discuss your proposal ideas prior to submission. Indeed, one job of an NSF program director is outreach and proactive discussions with potential principal investigators. Often, additional ideas or improvements come about during these early discussions, and it is also a good time to establish whether the project fits well with the program's core pillars.

Another thing to do is to gain a very clear understanding of NSF's proposal guidelines. On NSF's website, there is a lot of information about the review process, and its main criteria for intellectual merit and broader impact (e.g., what counts as broader impact, etc.). Particularly for those new to submitting NSF proposals, it pays off to get a better understanding of this, as submissions are going to be judged on that basis. In fact, there's a very useful video for prospective PIs that you can find here:

https://www.nsf.gov/news/mmg/mmg_disp.jsp?med_id=76467

Is there an approximate number of projects that you foresee to sponsor through HDBE? How big is the budget?

The FY17 budget was about \$4M, and while this year's budget is not out yet, it is expected that this year's budget will be around that same figure. Assuming a ballpark average of about \$400,000 per project, the program could fund about 10 projects this year. With an increase in disasters that we've seen over the last year, there might be an increase in the budget as well. However, it is important to recognize that there are a number of different programs across NSF that focus on disasters, depending on the project's main research domain. For instance, HDBE is within engineering. The geosciences division and the social behavioral and economic division also have programs related to disasters. Again, what sets the HDBE program apart is the connection between the three core pillars of humans, disasters and the built environment.

Given the response and recovery after the Hurricanes Harvey, Irma, and Maria, the forest fires out West, how do you see this program ultimately being able to pivot university research into transforming how we prepare, adapt and respond to future disasters?

I think our program incentivizes relevant research. NSF and other funding agencies want to have an impact on reducing disaster costs, and this is one of several ways to do it. By incentivizing fundamental research on how we change people's behavior, the decision making, as well as engineering and technology—if anything it's at least good start.

What are the deadlines for applying? Is there anything else you would like to add?

There are two recurring windows to submit proposals, one in January and another one in September, for all of the unsolicited proposals. Proposals can be submitted within a two-week period during those months.

Junior researcher should also be aware of the CAREER awards, typically due in mid-July. CAREER is a special program for assistant professors and consists of a \$500,000 award over five years. Criteria for this award go beyond the usual intellectual merit and broader impact, in that it also requires a strong educational component.

Another proposal solicitation to bring to the community's attention is the CRISP (Critical Resilient Interdependent Infrastructure Systems and Processes) opportunity. This program focusses on interdependent infrastructure and requires inclusion of social, behavioral, or economic sciences. Proposals for this solicitation are due March 7, 2018.

A last thing to consider is that NSF is focused on what we call the 10 Big Ideas. One of those is focused on engineering the Arctic, as mentioned in a recent NSF Dear Colleague Letter (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf18029). This means that someone working on one of these 10 Big Ideas, especially the theme of the Arctic, is particularly encouraged to submit a relevant proposal.

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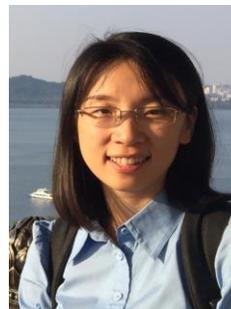
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