

DECISION

ANALYSIS

TODAY

Vol. 34, No. 1, May 2015



The newsletter of the INFORMS Decision Analysis Society

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President's Letter

Bickel, J. Eric



Dear DAS Members,

I hope this issue of DA Today finds you well and looking forward to a wonderful summer!

Your DAS leadership team has been busy over the last few months. We have been attending to the day-to-day operations of the society and have also kicked-off some new initiatives, which we hope will be complete by our annual meeting in November.

To start, we have been working with INFORMS to improve our ability to monitor our financial health. This included closing the books on the 2014 Advances in Decision Analysis Conference and the 50th Anniversary of Decision Analysis Gala Celebration. In total, these events provided about \$24,000 in net revenue to the society! To put that in perspective, before this infusion, our

cash reserves were down to less than \$5000. As you can see, these events have dramatically improved our financial situation. Please join me in thanking everyone that made these events happen!

Debarun Bhattacharjya, Melissa Kenney, and Mazen Skaf continue to plan the DAS track at INFORMS 2015. INFORMS had planned to limit the number of talks any individual could give (as lead presenter) to one. As DAS President, it is my view that INFORMS is justified in constraining the total number of sessions DAS can offer, but that the members of the society should decide how to allocate the sessions within our track. I have communicated this to INFORMS and, at least for this year, the speaking limit will not be enforced. That being said, the DAS desires to hear from a range of speakers and may enforce its own speaking limits.

All of the DAS awards are moving forward and actively seeking nominations. As I mentioned last time, Ron Howard is chairing the Ramsey Medal, Frank Koch is chairing the Practice Award, Kevin McCardle is chairing the Publications Award, and Robert Hammond and Canan Ulu are co-chairing the Student Paper Award.

Joe Hahn, Phil Beccue and Vicki Bier are spearheading an effort to improve how we manage our membership. Specifically, we would like to keep better track of members, welcome new members and follow up with members that do not renew. The latter is especially important given our movement to InformsConnect as the way to communicate with our membership. Currently, if a DAS member does not renew they are no longer included in the InformsConnect email list and will no longer hear from us. This makes it quite easy for someone that forgets to renew to become lost. We are also reconsidering our student membership model. Finally, we are investigating the creation of an honorary membership class.

Victor Jose and Bob Nau have launched a contest to design a new DAS logo! This looks to be a very exciting and fun opportunity and I hope you will participate. We would like to present the new logo during Informs 2015.

Jason Merrick and Casey Lichtendahl are starting to make plans for the 2016 Advances in Decision Analysis Conference. I hope to have more details to share in a few months. Given the revenue that this activity can provide to the society, it is important that we fully support it.

Heather Rosoff, Jun Zhuang, and Jing Zhang continue to produce this fine newsletter!

Once again, I can't say enough about all the hard work that everyone puts into making DAS the best society it can be! If you would like to get involved or have an idea for initiative that you think is important, please email me (ebickel@utexas.edu).

Until next time, and with my best regards,

Eric

Letter from the Editors

Heather Rosoff, Jun Zhuang, and Jing Zhang

Hello everyone,

Greetings and a warm welcome to the second newsletter of 2015! We hope that you are having a productive Spring and we imagine you are preparing for summer fun. The last few months have been very busy for us. Jun has been on his first sabbatical leave and is currently in China, Jing has been working on attacker-defender games considering risk preferences, and Heather has been exploring new methods and approaches for using DA techniques in the study of terrorism. Who knows what the summer will bring!!

We want to take a moment to thank our Column Editors for their ongoing commitment to the newsletter. If you are interested in joining our team, please do not hesitate to contact us.

Now without further ado, we have a very interesting newsletter for you. We open with a list of conferences, call for presentations/papers, book announcement, and contributed research in progress report. In Matthias Seifert's column, DA Around the World, he introduces us to Professor Leo Kaas who describes the graduate school of decision sciences at the University of Konstanz, Germany. This is followed by Larry Neal's contribution in the DA Practice column, where he shares his experiences with the Raiffa – Howard award process. Next, Eva Chen and David V. Budescu introduce us to the "Contribution Weighted Model" for forecasting future events in Debarun Bhattacharjya's Research column. We close with the Ask DAS column in which Florian Federspiel focuses on how to tackle the DA job market in academia.

By the way, Jun and Vicki are organizing the Second Conference on Validating Models of Adversary Behavior around the beautiful Niagara Falls in early August! No snow guaranteed! ☺ Everyone are welcome and see page 6 for more information.

Enjoy the read, keep sharing exciting DA news, and as always, we welcome comments, ideas and questions.

With warmest thanks,

Heather, Jun, and Jing

Upcoming Conferences

May 30 - June 2, 2015

2015 Industrial and Systems Engineering Research Conference

Renaissance Nashville Hotel, Nashville, Tennessee

www.iienet.org/annual

July 12- July 15, 2015

27th European Conference on Operational Research

University of Strathclyde

<http://euro2015.org/>

August 2- August 5, 2015

Second Conference on Validating Models of Adversary Behaviors

Buffalo/Niagara Falls, NY, USA

engineering.buffalo.edu/vmab-conference

September 10- September 11, 2015

IEOM International Conference on Operations Excellence and Service Engineering

Rosen Plaza Hotel, International Dr.

Orlando, Florida, USA

<http://iieom.org/icmoe2015/>

November 1- November 4, 2015

INFORMS Annual Meeting

Pennsylvania Convention Center & Marriott Philadelphia Downtown

Philadelphia, PA

<http://meetings.informs.org/philadelphia2015>

December 6 to December 10, 2015

Society for Risk Analysis Annual Meeting

Crystal Gateway Marriott

Arlington, Virginia

<http://sra.org/events/sra-2015-annual-meeting>

Call for papers: 2015 INFORMS DAS Student Paper Award

Submission deadline: June 01, 2015

The Student Paper Award is given annually to the best decision analysis paper by a student author, as judged by a panel of the Decision Analysis Society of INFORMS. Students who did not complete their Ph.D. prior to May 1, 2014 are eligible for this year's competition.

The award is accompanied by a plaque and a \$500 honorarium. The award will be presented and the winner will also be invited to present his or her paper at the DAS Awards Session at the INFORMS Annual Meeting to be held in Philadelphia, Pennsylvania, November 1-4, 2015.

All students doing work in or related to decision analysis (e.g., decision methodologies, experimental studies, and applications) are encouraged to submit a paper. The majority of work, including writing, must be that of the student, though faculty members or other mentors can be co-authors if appropriate. The paper should be 30 pages or less (double spaced and 12 point font) and, in the standard format of Management Science or Operations Research.

If you are a faculty member who is supervising students, please inform them of this opportunity. If you are a student reading this, please encourage your classmates (and yourself) to submit a paper and to join the Decision Analysis Society (<http://www.informs.org/Community/DAS>). While we encourage all applicants to join DAS, it is not necessary for students to be members in order to be eligible for the competition.

To be considered for this year's competition, please email both committee co-chairs, at the address given below, by the deadline, June 01, 2015, with your final submission of:

- (i) An electronic version of your paper in PDF format, and
- (ii) A letter in PDF format from one faculty co-author (if any) articulating your role in writing this paper.

Let us know if you have any questions.

Robert Hammond
Decision Analyst
Chevron, Houston, Texas
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Canan Ulu
Assistant Professor
McDough School of Business, Georgetown University
Email: Canan.Ulu@georgetown.edu

Call for Participation and Poster Submission: Second Conference on Validating Models of Adversary Behavior

Date: August 2-5, 2015

Location: Holiday Inn hotel, Niagara Falls, NY, USA (just 10-min walk to the beautiful Niagara Falls with free entrance!!)

Web site and registration: engineering.buffalo.edu/vmab-conference

Early-bird Registration Deadline: June 14, 2015

Registration Deadline: July 25, 2015 or by contacting the organizers

Hundreds of billions of dollars have been spent on homeland security since September 11, 2001, and numerous models have been developed to study the strategic interactions between defenders and adversaries (e.g., attackers or terrorists). Unfortunately, few models have yet been validated using empirical data, limiting the application of those models in practice.

Following a successful conference in June 2013, Drs. Jun Zhuang and Vicki Bier are organizing a second conference on validating models of adversary behavior in Buffalo/Niagara Falls, NY, in August 2-5, 2015. This conference is intended to bridge theoretical and empirical research on adversarial modeling, and facilitate transitioning of the best existing models of adversary behavior into practice by assessing and demonstrating their validity and applicability to real-world problems. A secondary goal of the conference is to encourage synergy and communication between risk analysts, statisticians, economists, and other social scientists engaged in terrorism modeling and research.

Our confirmed speakers/participants include:

Ali Abbas (University of Southern California/CREATE)

Bo An (Nanyang Technological University, Singapore)

Victor Asal (University at Albany, SUNY)

Aniruddha Â Bagchi (Kennesaw State University)

Nitin Bakshi (London Business School, UK)

Opher Baron (University of Toronto, Canada)

Atin Basu (Virginia Military Institute)

Oded Berman (University of Toronto, Canada)

Greg Bernard (Department of Homeland Security-DNDO)

Vicki Bier (University of Wisconsin-Madison)

João José de Farias Neto (Instituto de Estudos Avançados, Brazil)

Kjell Hausken (University of Stavanger, Norway)
Richard John (USC/CREATE)
Steve Johnson (Cranfield University, UK)
John Lathrop (Innovative Decisions, Inc.)
Igor Linkov (U.S. Army Corps of Engineers, ERDC)
Hamid Mohtadi (University of Wisconsin-Milwaukee)
Jiyoung Park (University at Buffalo)
H. Raghav Rao (University at Buffalo)
Jesus m Rios aliaga (IBM)
Robert Sargent (Syracuse University)
Moises Sudit (CUBRC/University at Buffalo)
Chen Wang (Tsinghua University, China)
Scott White (Department of Homeland Security-ST, BTRA/ITRA)
Jun Zhuang (University at Buffalo)

The poster presentation and competition will be held on August 3 during the dinner buffet reception. The student poster presentation winner will be awarded a certificate, as well as a \$500 gift card from a brand at his/her choice.

Let us know if you have any questions.

Sincerely,

Conference chairs:

Jun Zhuang
Department of Industrial and Systems Engineering, University at Buffalo, SUNY

Vicki Bier
Department of Industrial and Systems Engineering, University of Wisconsin-Madison

Book Announcement

Project Think: Why Good Managers Make Poor Project Choices

Authors: Lev Virine and Michael Trumper

Hardcover: 235 pages

Publisher: Gower Pub Co; New edition

Language: English

ISBN-10: 1409454983

ISBN-13: 978-1409454984

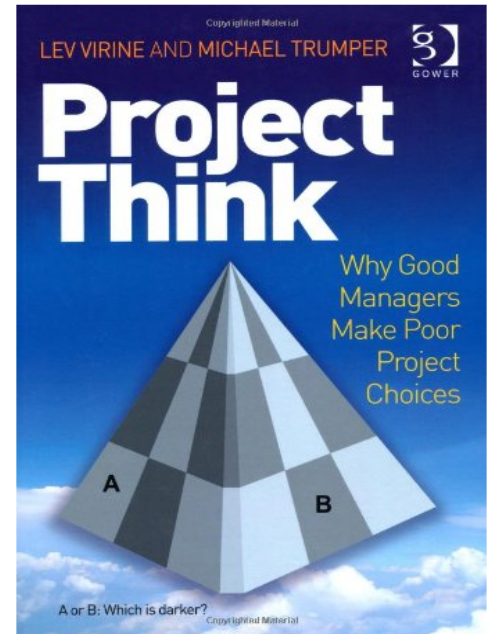
Web site: <http://www.projectdecisions.org>

New book “ProjectThink: Why Good Managers Make Poor Project Choices” by Lev Virine and Michael Trumper talks about applying decision and risk analysis theory to project management. Projects are constantly beset by problems, often caused by seemingly small mistakes which collectively lead to larger issues. Why do project managers and teams appear to repeat the same mistakes? Can they make better choices without introducing complex decision analysis processes? How can they make better estimates?

Project management is the art and science of human interactions. ProjectThink identifies and explains the paths of those intentional and unintentional actions that lead to project failures. It provides advice and guidance in analysing information and risks and explains how analysis can facilitate decision-making and encourage everyone involved in a project to follow the right procedures and work collaboratively.

The authors applied choice architecture concept to project management. They proposed Choice Engineering as a choice architecture related framework for improving project decisions. Choice Engineering is the creation of processes or environment in which project managers would be steered towards making better choices rather than mandating these choices. The authors argued that in many cases, especially for smaller projects, it would be more beneficial to use Choice Engineering rather than strict and complex project management processes.

This book is for anybody who is involved in projects. ProjectThink doesn't involve learning formulas or understanding complex analyses. This book is an important addition to the literature on project decision making and was awarded the 2014 PMI David Cleland Project Management Literature Award for its significant contribution to the advancement of project management knowledge, concepts, and practice.



Contributed Research in progress: using Value of Information to inform medical decision making on lost to follow-up dynamics for HIV infected patients in resource-poor settings

Author: Lingfeng Li, PhD Research Scientist

Lost to follow-up (LTFU) of antiretroviral therapy (ART) programs has become a great threat in reducing the effectiveness of HIV treatment [1,2]. LTFU dynamics for HIV infected patients can be demonstrated in Figure 1. In Figure 1, patients can stay in HIV care and in clinic (ES1), disengage from clinic but in care elsewhere (ES3), completely disengage from care (ES4), or be in death states (ES6 and ES7). The engagement status affects patients' clinical, immunological, and virological status by varying ART compliance. Poor ART engagement leads to higher HIV related mortality.

Therefore, retention in care (RIC) strategies including risk reduction interventions [3-5] and outreach interventions [1, 2, 6-8] were introduced to reduce LTFU and improve care engagement. If the prior knowledge of LTFU dynamics in HIV clinics or consortium in Figure 1 is insufficient, it may be worthwhile to conduct new studies to eliminate uncertainties in LTFU dynamics before the implementation of any RIC strategies. Otherwise, the opportunity cost of applying a non-optimal RIC strategy will be enormous given a limited number of medical resources in resource-poor regions. An example of a list of variables of interest that cause decision bias is given in Table 1.

Given the efficacy of RIC strategies and prior information of LTFU dynamics, policy makers in ART programs often wonder: 1) whether it is worthwhile to conduct additional studies to address uncertainties on variables of interest in Table 1; 2) whether additional studies are necessary, how to prioritize studies given a budget constraint; 3) how to determine the optimal sample size of a new RIC study because insufficient number of samples cannot provide strong evidence to support decision-making. However, a large sample size may not be affordable or cost-effective since extra funds can be allocated to other medical researches that yield more health benefit.

Value of information (VOI) is a useful tool to resolve above research questions. In a pilot study, we applied VOI to inform medical decision making for policy makers in ART programs in East Africa. We assumed two strategies and three studies in this pilot study. Strategy 1: to apply an outreach intervention. Strategy 2: do nothing (base case). Study 1: to investigate the proportion of non-death related LTFU. Study 2: to study the proportion of clinic transfers. Study 3: to obtain additional information about the proportion of unreported deaths. From the cost-effectiveness acceptability curve in Figure 2, we found that when willingness to pay (WTP) is less than \$2,700/QALY, do-nothing is more likely to be cost-effective, whereas, the outreach strategy is more likely to be cost-effective when WTP is greater than \$2,700/QALY. Moreover, when WTP is around \$2,700/QALY, which is also the incremental cost-effectiveness ratio (ICER) of RIC strategies, performing studies 1, 2, and 3 will yield the most monetary benefit (Figure 2). The expected value of partial perfect information (EVPPI) for each study was provided in Figure 3. Our preliminary result suggests that Study 1 should be the first priority when the budget of performing additional studies is limited since Study 1 returns the greatest EVPPI. EVPPIs are the upper bounds for

performing the studies. In Figure 4, the expected value of sample information (EVSI) is provided over a range of sample sizes for Study 1. EVSI and the cost of sampling (Cs) increase with the increment of sample size in Figure 4. The optimal sample size was obtained by maximizing the expected net benefit of sampling (ENBS), which is the difference between EVSI and Cs. The optimal sample size to conduct a further research on the proportion of non-death related LTFU is 150.

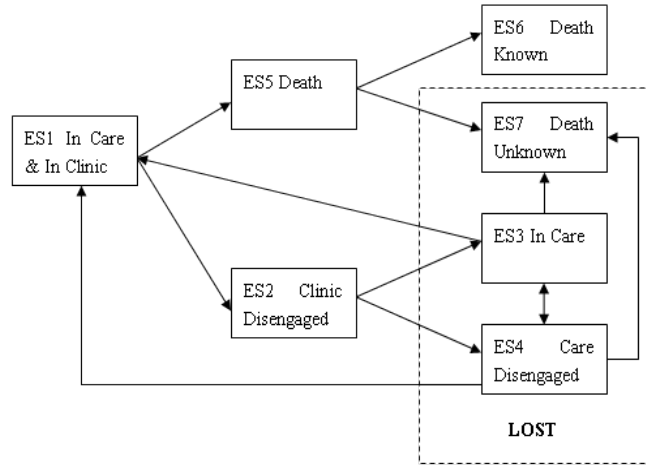


Figure 1 LTFU dynamics (ES: Engagement State)

Table 1 Some variables of interest in LTFU dynamics and their estimated prior information [2]

Variable	Mean	Distribution
Proportion of non-death related LTFU	62%	Beta (79, 49)
Proportion of clinic transfers in LTFU population	83%	Beta (40, 8)
Proportion disengaged from care in LTFU population	17%	Complement of proportion of clinic transfers ¹
Probability of disengaging from non-ISS clinics	0.000286/day	Constant ²
Proportion of unknown death ³	14.6%	Beta (64, 378)
Proportion of known death	85.4%	Complement of proportion of unknown death
Mean time from last clinic visit to death	90 days	Constant

¹ Alive LTFU patients either transfer to other clinics or disengage from care. Thus, this variable is the complement of proportion of clinic

² We assume this probability is equivalent to the probability of ISS clinic disengagement.

³ This variable indicates that on average, 14.6% of the deaths are unreported deaths.

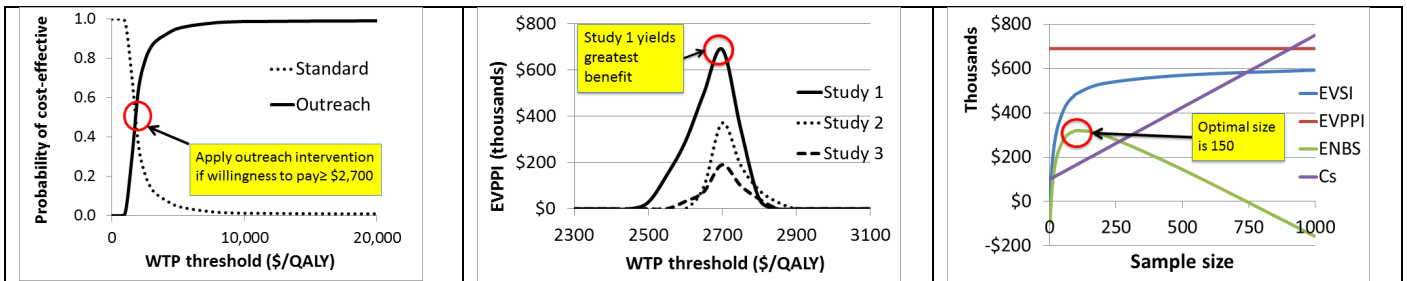


Figure 2 The cost-effectiveness acceptability curve

Figure 3 EVPPI curves

Figure 4 EVSI, EVPPI, ENBS, and Cs curves for Study 1

WTP: wiliness to pay, which is how much a policy maker is willing to pay for a quality-adjusted life year (QALY)

EVPPI: expected value of partial perfect information/expected value of perfect information for parameters

EVSI: expected value of sample information

ENBS: expected net benefit of sampling

Cs: cost of sampling

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The *Decision Analysis* March 2015 Issue

<http://da.journal.informs.org/content/12/1.toc>



Non-Convex Equilibrium Prices in Prediction Markets

Ashwin K. Seshadri

Abstract: Prediction markets are increasingly being used to estimate probabilities of future events, and market equilibrium prices depend on the distribution of subjective probabilities of underlying events. When each contract requires the payment of a dollar if the underlying event were to occur, equilibrium prices are usually used to estimate the mean probabilities of the corresponding events. This paper shows that under certain conditions, market equilibrium prices of such contracts can lie outside the convex hull of potential traders' probability beliefs, and where this occurs, market forecasts can induce stochastically dominated group decisions. We describe examples of where this could occur and generalize these examples to characterize conditions for nonconvex prices. A necessary condition for nonconvex prices is that market risk premia for complementary contracts have opposite signs. Preference functions on the lines of prospect theory have this property.

For more: <http://dx.doi.org/10.1287/deca.2014.0306>

Project Management Decisions with Uncertain Targets

Jeffrey M. Keisler and Robert Bordley

Abstract: Project management decision rules presume that fixed and inflexible targets have been defined for the project. If a project's slack is defined as the difference between actual project performance and these targets, then these decision rules can be characterized as maximizing the probability that slack is nonnegative (i.e., maximizing the probability of meeting the targets). These rules rely on z-scores to compare uncertain performance to target levels. Following these decision rules will not always suffice for the project manager to act consistently with customer preferences. In particular, actual requirements may be uncertain or subject to change, and customers may have some flexibility. A decision-analytic approach accounting for these factors can allow the project manager to maximize the customer's expected utility. We redefine project slack to reflect the difference between performance and a random target that reflects both the customer's risk tolerance and uncertainty about the actual requirement. The z-score associated with this slack is shown to be proportional to the certainty equivalent for a project. Thus utility-maximizing decision rules in the language of decision analysis can be readily translated into z-score-maximizing decision rules in the language of project management. From this, we discuss how related decision-analytic concepts such as value of information might be applied to families of problems in project management.

For more: <http://dx.doi.org/10.1287/deca.2014.0305>

Collaborative Decision Making

Daniel Owen

Abstract: A synthesis of the work of three noted authors provides a framework for collaborative decisions built on the foundation of decision analysis. A Nobel Prize winner provides a psychological foundation for the framework, an authority on harnessing the collective wisdom of organizations argues for the necessity of a mechanism for the aggregation of the decision makers' understandings, and a former senior executive for a Fortune 500 company describes a series of structured dialogues that supports the aggregation of understandings.

The resulting collaborative decision process aggregates, rather than compromises, the understandings of decision makers. It makes explicit the aggregation of individuals' understandings of the frame of the decision to be made, the alternatives to be considered, the sources of value and risk, and, finally, the reasons for the resulting collaborative choice.

In collaborative decision making, we do not strive for an optimum, a compromise, or a satisficing solution. Rather, collaborative decision making results in a significantly more valuable choice than the alternatives envisioned by any of the decision makers through the aggregation understandings. Though the collaborative choice was not envisioned by the decision makers, each feels ownership of it and explicitly agrees to implement it.

For more: <http://dx.doi.org/10.1287/deca.2014.0307>

Deciding on the Decision Situation to Analyze: The Critical First Step of a Decision Analysis

Roberto Ley-Borrás

Abstract: Using the right decision frame, in the sense of selecting the right decision situation to analyze, is regarded as a critical part of a decision analysis effort, but there are few guidelines on how to systematically generate alternative decision situations and how to select the best one. In practice, the decision situation is typically not explicitly selected, or even well defined, which easily leads to deciding about treating symptoms instead of underlying causes; to deciding with a narrow scope that misses important elements; and, in general, to missing the opportunity of analyzing valuable alternative decision situations.

This paper presents several distinctions and three approaches for generating significantly different decision situations and selecting the one that is best for the decision maker's current priorities and circumstances. A key element of this work is treating the selection of the decision situation as a decision in its own right and using decision analysis tools to generate a rich set of alternative decision situations and gain clarity on which element of the set is most valuable to analyze.

For more: <http://dx.doi.org/10.1287/deca.2014.0308>

Coming soon...

The *Decision Analysis* June 2015 Issue **Possibility Engineering**

James C. Felli

Abstract: Possibility engineering is a variant of decision analysis that focuses on highlighting a robust set of acceptable courses of action that satisfy a decision maker's value constraints rather than identifying and prescribing a single, optimal course of action. A shift from a conventional decision-analytic approach to a possibility engineering approach can facilitate problem resolution by sparing decision makers from misconceptions surrounding the term “decision analysis” and freeing them from its demands for structural precision, preferential fidelity, and prescription adherence. In this work, I will develop possibility engineering as a framework for resolving problems of choice under uncertainty. This development will include motivation for adopting a possibility engineering framework, establishment of synthetic probabilities and synthetic decision trees as core framework elements, formalization of concatenation and clone operations for matrices, and ultimately establishment of the possibility matrix as the mechanism for partitioning the set of all available courses of action in a manner consistent with the decision maker's value constraints.

Weighted Almost Stochastic Dominance: Revealing the Preferences of Most Decision Makers in the St. Petersburg Paradox

Chin Hon Tan

Abstract: There are instances where “most” individuals prefer one prospect over another in practice, but such preferences are not revealed by conventional stochastic dominance rules. Almost stochastic dominance aims to reveal such preferences. However, almost stochastic dominance does not reveal the preferences observed in the St. Petersburg paradox. In this paper, we generalize the conditions of almost stochastic dominance by introducing a weighting function and illustrate how our proposed condition reveals the preferences of most individuals in the St. Petersburg paradox.

For more: <http://dx.doi.org/10.1287/deca.2014.0310>

Air Force Cyberspace Investment Analysis

Gregory S. Parnell, Rudolph E. Butler III, Stephen J. Wichmann, Mike Tedeschi, and David Merritt

Abstract: Space and cyberspace operations are primary missions within the U.S. Armed Forces. Air Force Space Command performs investment planning for Air Force space and cyberspace missions. The command has performed space investment planning for more than 15 years using multiobjective decision analysis to assess the value of space programs for military operations and an optimization model to maximize space capabilities subject to performance, budget, schedule, and programmatic constraints. Air Force cyberspace operations and investment planning were assigned to Air Force Space Command in 2009. We developed an improved cyberspace investment analysis method using decision analysis techniques to support investment planning for the Air Force's approximately \$3.5 billion annual cyberspace investment. We developed four models to assess the value of Air Force cyberspace programs: a multiobjective decision analysis model for information technology infrastructure, a probability model to assess the capability to defend Air Force networks, a probability model to assess the capability to command and control cyberspace assets, and a probability model to assess the capability to perform cyberspace attacks when directed by national command authorities. The models were incorporated into the Air Force Space Command Integrated Planning Process and have been used for three years.

For more: <http://dx.doi.org/10.1287/deca.2014.0311>

An Empirical Examination of Multiple Objective Risk Attitudes

William K. Klimack, Jack M. Kloeber Jr., Kenneth W. Bauer, and Mark E. Oxley

Abstract: We experimentally examined the relationships between the measurable value and utility functions of a nonmonetary multidimensional decision situation for a number of subjects. We found that value and utility were not equivalent constructs. We tested five families of functions and found the sigmoid function performed best as a transform from value to utility. Constant relative risk aversion was not observed. The methods of probability equivalent and certainty equivalent utility elicitation provided similar results, which differs from previous work using economic decisions.

For more: <http://dx.doi.org/10.1287/deca.2015.0312>

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: Matthias Seifert



Guest Contributor: Leo Kaas (University of Konstanz)

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 will focus on a highly interesting recent development in the German research landscape. Since 2006/2007, as part of its mission to promote clusters of research excellence and establish a group of “elite institutions”, the German government has been heavily funding a small group of universities that are chosen every few years as the result of a competitive process. In each of the two selection rounds that have been conducted so far, the University of Konstanz has been among the few lucky winners and the university has used a significant portion of the obtained funds to set up a brand new, interdisciplinary Graduate School of Decision Sciences, which nowadays houses 36 affiliated principal investigators, 19 junior investigators, as well as more than 50 doctoral students and is currently the only one of its kind in Germany.

In the following section, we have the pleasure to hear from Professor Leo Kaas, Coordinator of the graduate school and current Chair of Economic Theory, about the school’s mission and activities conducted. I hope you enjoy reading about this local DA community and I encourage you to get in touch with our guest contributor if you are interested in learning more (Leo.Kaas@uni-konstanz.de).

Graduate School of Decision Sciences – University of Konstanz

Our Graduate School offers an ideal training and research environment for doctoral students concerned with decision making and its applications to important social science issues. It combines the perspectives of the various social science disciplines and gains from this interface a comprehensive understanding of human decision behaviour and its economic and political consequences. The three disciplines, economics, political science and psychology, constitute the main focus of the School. Our faculty also includes researchers from computer science, sociology and statistics. The Graduate School of Decision Sciences is funded by the Excellence Initiative of the German federal and state governments.

The School offers doctoral students a stimulating learning and research context, with a broad spectrum of courses and seminars, as well as an open and communicative academic environment. Doctoral students benefit from our connections to a wide variety of national and international network partners. They also

receive targeted career preparation to facilitate their entry into assistant professorships and postdoctoral positions at leading international research institutions or into top positions in the private or public sectors.

The Graduate School is structured into four interdisciplinary **research areas**, between which various cross-connections exist. Within the first year of the Graduate School, doctoral students select one major and one minor research area in which they participate in several courses and research seminars.

Area A: Behavioural Decision Making

Researchers in this area specialise in behavioural/experimental economics, social/motivational psychology or cognitive psychology and explore the foundations of human decision processes and their applications.

Area B: Intertemporal Choice and Markets

Doctoral students specialising in this area analyse individual decisions over longer planning horizons and their market consequences are typical research applications in the fields of finance, labour and personnel economics, or micro- and macroeconomics.

Area C: Political Decisions and Institutions

Collective decisions are the keystone for research in political science and political economy. Doctoral students working in these fields typically combine formal modelling and advanced empirical strategies to study collective decision making.

Area D: Information Processing and Statistical Analysis

Issues of data generation and data analysis in the social sciences provide the research questions in this area, which comprises those researchers with a more methodological orientation.

Admission Requirements

Applications are welcome from highly motivated Master's graduates and pending graduates with an outstanding Master's degree relevant to one of the disciplines or research areas of the Graduate School. Relevant degrees for admission to the Graduate School are, for instance, business administration, computer and information science, decision sciences, economics, mathematics, political science, psychology, public administration, sociology or statistics.

The **application deadline** for admission in October is **15th April**.

For further information, please visit gsds.uni-konstanz.de

DA Practice

Column Editor: Larry Neal

The Raiffa-Howard Award Experience



Hello again everyone. As I said in my January column, I wanted to use this edition to share my experiences with the Raiffa – Howard award process. For those who may have missed the prior column, my employer, Chevron, was awarded the inaugural award in San Francisco last November. I had the lead in preparing for the examination process and came away from the experience with a different view of DA, DQ and my nearly 25 year journey in using it. I think some of my learnings may be useful for some of you.

The Process

The Raiffa-Howard Award examination process isn't overly complicated. It entails a visit by a panel of examiners selected from a pool of volunteers from the Society of Decision Professionals (SDP). To insure that there are no conflicts of interest or a potential for divulging of proprietary information to competitors, the examiners were hand selected by the examiner committee chair and appropriate confidentiality agreements were put in place.

The examiners conducted a series of phone interviews with employees and business partners and visited our Houston offices for two days. We conducted a half day overview of our company and provided the examiners with evidence we felt demonstrated that we met the award criteria. The examiners conducted additional face-to-face interviews and we held a final session to fill in any gaps or answer questions.

The whole experience was intellectually stimulating and quite energizing. To spend nearly two days face-to-face with a group of SDP Fellows was a real treat.

Getting to No

As I began to prepare the agenda for the examiner visit, I reflected on decisions I felt best demonstrated Chevron's achievement of good Decision Quality (DQ). It was sort of a mental top ten list of big decisions from the last 25 years.

As I drew up that list, a bit of a revelation occurred - more than half of those decisions were situations that we said "no" to the opportunity. In fact, the big decision that really helped put DA/DQ on the map for us in the early 1990's was one of them.

Think about that for a moment. Many of those investment decisions were walking away. When you're making the case for the value of DQ in your work, where does "no" fit into the equation?

Taking this revelation out of the monetary world of business into the real life world of parenting, it makes perfect sense. When raising a child, your first concerns are the bad things, drugs, gangs, drinking while

driving, all those choices that are likely to preclude your child's ability to live a long, productive, and happy life. One or two bad decisions can ruin a life. It's the same for a business, one or two bad investment decisions and you can end up in the scrap heap.

I'm sure you'll be hearing more from me on this issue. I honestly think we've missed a key point in our efforts to promote DQ.

Small is Big

After working my way through the big decisions, I started looking for evidence of good DQ in other parts of the business. As a big fan of Carl Gustav Jacob Jacobi who famously said "invert always invert", I did just that.

I had been looking at capital decisions, what about expense decisions? It's not widely understood that in the oil and gas business, companies often spend just as much or more on operating expenses as they do capital. In Chevron's case, that's tens of billions of dollars every year. The thing is, these expense decisions are generally smaller and more frequent than the big bets.

Preventative Maintenance

My search to find elements of DQ in the expense world didn't take very long. Data intensive tools and processes had built in periodic checks to test the quality of the input data against the foundational assumptions or frame. In other words, the users of these tools don't wait until results begin to bring the usefulness of the tool into question, they scheduled reviews on a periodic basis to confirm the validity of the underlying data. The old adage "if it ain't broke don't fix it" didn't apply here. Literally thousands of decisions are made daily using these tools.

Ready, Fire, Aim

In another finding, I found situations where the amount of DA conducted on certain investment types was reduced substantially with very little loss of DQ, enabling engineers to increase the number of these investments possible in a given budget year.

In one case, investing in a certain class of oil wells, the engineers noticed that many aspects of the DA output were essentially identical. With help from their local decision professional, they reviewed the typical process steps and customized the work to scale the effort to fit the situation. Think of it as a sensitivity analysis on the DA process and selecting only those tools and processes that address the key uncertainties from well to well.

The engineers again periodically review their scaled process using the distribution of results as an indicator of the process applicability.

Double Loop Learning

I was introduced to Argyris' concept of "double loop learning" by Vince Barabba during a presentation he made at DAAG a few years ago. I really hadn't put much thought into the concept until I started considering the learnings above and then looking at our fundamental approach to the DA process and DQ.

In the double loop learning process there is an inner loop, looking at “how” we do things, and an outer loop looking at the “why” we do things.

It’s clear from the examples above that we pay considerable attention to the inner loop or the “how” we do things. What could I say about outer loop or the “why”?

Chevron has a very well defined “lookback” process on our capital decisions defined by company policy. I found many cases where the results of this lookback process had resulted in changes to the assumptions and guidance used in our decision making processes. We were changing the “why” along the way.

When I compared our decision making practices from 2 decades ago to now, I found evidence of streamlining certain aspects as well as expansion in others, leaning perhaps more to expansion than streamlining, mainly in the framing practices.

I concluded from this last review that as Barabba points out in his book “The Decision Loom”, a double learning loop is essential to a sustainable improvement in DQ. In fact, I’m thinking about personally adding a seventh element to DQ to reflect this in my future endeavors.

So that’s it for this issue. I hope you at least found this interesting if not useful.

As always, I’m open and anxious to hear your ideas for this column. Please contact me at lnealjr@wildblue.net with your ideas.

Research

Column Editor: Debarun Bhattacharjya



The Contribution Weighted Model: Identification and Combination of Expertise

By: Eva Chen (University of Pennsylvania) and David V. Budescu (Fordham University)

When David Ferruci, Chief engineer of “Watson”, an IBM cognitive system that beat the (human) champion on the television game Jeopardy!, was interviewed on the value of human expert judgment, he said that, at present, computer systems could easily answer the question: “which two Russian leaders traded jobs?” But, these systems are far from being able to answer a prospective question like “which two Russian leader *will* trade jobs?” Ferruci explains that humans hold expertise, which goes beyond just an information search to deduction and judgment (Tetlock and Gardner, 2015). Thus, human judgment continues to play an important role in providing informed advice and forecasts about future events in the service of decision making at the individual, organizational, societal and international levels.

When forecasting future events it is natural to seek expertise in the relevant domain in order to achieve maximal accuracy and efficiency. Expertise is often hard to recognize and people may rely on various cues such as the forecasters’ experience, education and confidence, but these are not always diagnostic. Furthermore, human judgment is subject to many shortcomings due to cognitive limitations, motivational biases and social pressures (e.g. Gilovich, Griffin & Kahneman, 2002). Instead of looking for the expert(s) of the highest *quality*, an alternative solution is to emphasize *quantity* by assembling and employing large panels of judges (with various levels of expertise including, in some cases, non-experts) and aggregate their opinions to minimize the effect of individual errors (Budescu, 2006; Mannes, Soll and Larrick, 2014). This approach has a long tradition in social sciences (think, for example, of our routine reliance on juries and committees). Following the publication of Surowiecki’s (2004) best-selling book, this process of aggregating multiple opinions / estimates is often referred to as Wisdom of the Crowd (WoC).

We describe a new method that strikes a balance between these two extremes. Our approach identifies expertise, defined as the relative contribution of each of the various members of the crowd to the collective (aggregated) performance of the crowd. These measures of the expertise of the individual judges based on their past contributions *relative* to the others are applied by weighting differentially their forecasts regarding future events. We named our method the Contribution Weighted Model (CWM) (Budescu and Chen, 2015).

Consider a group of J judges who are updating periodically (e.g. daily, weekly, etc.) their forecasts to multiple items. Judges may not answer all the items and not everyone updates his / her forecasts at every point in time. Let P_{jit} be the forecast of judge (j) for item (i) at time (t).

The group’s aggregate forecast for event⁴ i ($i=1\dots I$), based on the subset of people who forecasted i at time t , is $P_{Git} = A(P_{jit})$, where $A(\cdot)$ is the aggregation function. In principle the aggregation can take many forms,

⁴ The terms event and item are used interchangeably in this context.

but in the vast majority of applications it involves some form of averaging of the individual forecasts. A judge's contribution to the group's performance on any item is computed by re-calculating the group's forecast, excluding the target judge, j . The new forecast of the "reduced group" is denoted $P_{(G-j)it}$. This calculation is performed for every judge who forecasted that item.

Once the item is resolved, we employ a merit function to score (e.g. a Brier score or AUC measure) the complete group and the reduced group. The merit score of the whole group is then $M_{Git} = f(P_{Git})$, where $f(\cdot)$ is the merit function, and the merit score of the reduced groups is $M_{(G-j)it} = f(P_{(G-j)it})$, where $j = 1 \dots J$. The contribution of j to the group's forecast of i at t , C_{jit} , is defined as the difference between the two merit values:

$$C_{jit} = M_{Git} - M_{(G-j)it}$$

This contribution value can be positive (negative) indicating that the group performs better (worse) in the presence of the judge j . A zero value signifies that the group's performance is unaffected by the presence / absence of that judge. By averaging across all I_j ($1 < I_j \leq I$) items that were answered by judge j , we obtain a measure of the his/her contribution to the group's performance, at time t :

$$C_{jt} = \sum C_{ijt} / I_j$$

The contributions, C_{jt} , describe the relative expertise of the various judges in the context of the group. It can vary over time with some judges increasing / decreasing their contributions as more items are being forecast. And, of course, judges' contributions can switch between being positive / negative over time.

In order to improve the group's forecast, we propose a weighted average of the forecasts of all positive contributors, where the weights, w_{jt} , are derived from these contributions. Weights are scaled such that all $w_{jt} \geq 0$, and $\sum w_{jt} = 1$. Thus, the proposed (contribution weighted) forecast for i at time $(t+1)$ (based on all events that were resolved by time t) is:

$$P_{Gi(t+1)} = A(w_{jt}, P_{ji(t+1)}),$$

where $A(\cdot)$ is the same aggregation function mentioned earlier.

For example, if the aggregation function is the mean, then the group's forecast is the weighted average of the individual forecasts using weights that reflect all previous forecasts:

$$P_{Gi(t+1)} = \sum w_{jt} P_{ji(t+1)}$$

In the CWM model, the weights are proportional to the contribution scores, but only judges with positive contributions are used. Thus, at any given point in time only about half of the judges are used but, as described above, the identity of the judges being assigned positive weights can change from one point to another. Thus, the aggregate forecasts are, truly, group forecasts that use the best subset of judges at various points in time. Formally:

$$w_{jt} = 0 \text{ if } C_{jt} \leq 0, \text{ and}$$

$$w_{jt} = (C_{jt} / \sum C_{jt}) \text{ if } C_{jt} > 0.$$

CWM is a dynamic model with contributions (and corresponding weights) that update when events are resolved (i.e., when we can ascertain the ground truth for an item).

Originally, we applied this model in the context of a large-scale longitudinal, geo-political forecasting study with about 200 items as well as data from the European Central Bank's (ECB) survey of professional forecasters over 14 years (since its inception). We found that it out-performed models based on equal weighting of all judges (the linear pool) and on weighting judges based on their *absolute* past performance (Budescu and Chen, 2015).

Recently we (Chen, Lakshmikanth, Budescu, Mellers and Tetlock, 2015) studied the effects of probabilistic training and teaming on forecasting by using data from the Good Judgment Project (Mellers, Ungar, Baron, Ramos, Gurcay, Fincher, Scott, Moore, Atanasov, Swift, Murray, Stone, and Tetlock, 2014). We found that both manipulations increase the level of expertise and the accuracy of the individual forecasts. Interestingly, the advantage of the CWM over the competing models was most pronounced in teams that were trained, so they had the highest level of expertise. We tested the robustness of the CWM by running the model at different points of the forecasting period of an event (e.g., using the judges' forecasts 4 weeks, 3 weeks, 2 weeks and 1 week before the event's resolution). The advantage of CWM over the competing models was most pronounced as the forecasting period was approaching its end, meaning CWM was best at identifying judges who had higher levels of information. In some instances, our model even beat a prediction market forecasting on the same items.

The advantage of CWM over simpler and more "intuitive" models is easily explained. Typically, most forecasts are highly and positively correlated (e.g., Broomell and Budescu, 2009), so there is high consensus among the judges and no single judge contributes much unique information. Moreover, judges can achieve high performance scores by forecasting only highly "predictable" (i.e. very easy) events. The CWM scheme rewards those judges who deviate, correctly, from the collective consensus and / or consistently lean in the right direction in hard to predict and controversial events that induce bimodal distributions of opinions.

To better understand the essence of CWM, we classified the judges who participated in the ECB survey into 4 subtypes: (1) *global experts*, who generally perform above the crowd's mean and have positive contributions in most periods; (2) *unskilled* forecasters, who perform below the crowd's mean most of the time; (3) *local experts*, who make better forecasts and have positive contributions only in certain periods, suggesting perhaps that they rely on information that is particularly diagnostic and valid at some times but not at others; and (4) *regressors towards the mean*, who make either excellent, or very poor, forecasts at the beginning, but slowly regress to the crowd's mean and 0 contribution. Figure 1 shows examples of the four types of contributors⁵.

⁵ Reproduced from Budescu and Chen (2015)

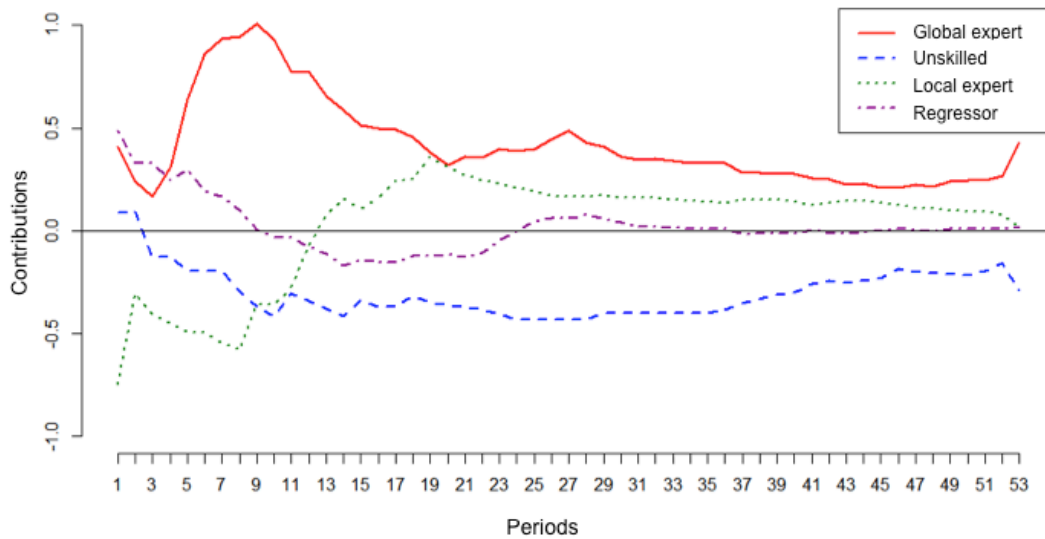


Figure 1: Examples of types of contributors

Thus, CWM (1) identifies consistent and persistent global experts (who always perform well and better than the crowd), (2) eliminates the unskilled performers, and (3) it also derives strength from being able to identify “local expertise” and properly rewarding those instances where the forecaster has effectively rendered judgment based on cues that are diagnostic only in particular circumstances and periods.

This analysis suggests that one’s pattern of contributions over many forecasts is quite predictable. Indeed, in a full analysis we found high correlations between the participants’ contributions up to 35 items apart. One could take advantage of this pattern to reduce considerably the size of the crowd without sacrificing much in terms of accuracy. Another intriguing possibility that we plan to explore in future work is the possibility of finding predictors such as one’s intelligence, personality and response styles that could help identify positive contributors.

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Ask DAS



Column Editor: Florian Federspiel **Finding an academic home as a Decision Analyst**

In reaching out to our readers for column topic ideas, the response has been extremely positive and I want to thank you for your feedback! Readers have inquired about a full range of topics including, for example, the relationship of our discipline with policy makers in government and other organizations and the future of Decision Analysis (DA) with respect to its relationship with other fields such as Analytics. In this particular issue, I focus on how to maneuver the job market as a decision analyst. I raise the question - are there common or recommended trajectories, tips or issues a candidate should know about? In the following pages, I focus on the academic job market, but plan to turn my attention to working as a decision analyst in 'the real world' in the next issue.

Most schools do not have a designated DA department (leaving aside possible differences between e.g. the terms DA, Decision Sciences, Decision Theory). Consequently, candidates who are not fortunate enough to land a job at a designated DA department are often forced to search for the most fitting position in, for instance, an Operations Management or Management Science (in the case of focusing on analytical research) or Organizational Behavior, and even Marketing (if focusing on more behavioral aspects) department. When looking at members of the DA Society, we are probably one of the most diverse societies in terms of departmental homes, not too surprising given DA's inter-disciplinary nature, with members belonging to a range of different departments, from Engineering to Psychology.

When approaching the job market, most candidates sooner or later face the question of positioning, in the sense of choosing or demonstrating belonging to a certain discipline, or targeted department. This may

start early, such as when choosing one's dissertation topic and target journals and doctoral committee, and extends later into the small details relative to how one writes his/her CV for a specific position. The downside of DA departments not being present at every school can on the other hand be seen as an opportunity to be able to position oneself for a variety of different departments and schools. This entire situation is assuming either some sort of academic 'soul searching' or a lack of tailor fit positions when simply following one's current situation. That is, a candidate at home in an Engineering department may simply consider jobs at other Engineering schools and in that sense never consider or require a different 'positioning'. Frequently, however, for decision analysts the issue of positioning may arise. Particularly business schools often have more ambiguous departmental divisions and what is considered DA is usually not home to the same department across schools (which means that a candidate may have to change departments, hence 'position' himself).

Positioning itself is, in theory, of course rather straightforward. When applying to an Operations (Management) department, it is probably helpful to look like an Operations and not an Organizational Behavior scholar, and vice versa. Positioning then mainly comes down to the choice of research problems, journals one publishes in, and the academic affiliations and networks one develops. There are limits to positioning but in a business school environment anything is possible. A move from any business school department to a non-business school department may be hard to impossible and unlikely in any case but the opposite is not necessarily true. If we consider business schools, the range of departments that could potentially house a decision analyst are Management Science, Operations, Statistics, Risk Analysis, Marketing, and Organizational Behavior. Beyond the business school sphere there are of course Engineering and Systems Analysis, Economics and Psychology departments.

The choice (if possible) of jobs pertaining to different departments brings with it a number of significant implications. For starters, whilst largely depending on the individual department and school, departments may generally have preferred journals for you to publish in. They will of course differ significantly between, say, an Operations department and a Marketing department. This 'preference' of journal outlets may be the single largest factor to consider because publishing in said journals substantially affects your performance evaluations and, last but not least, your tenure decision.

Furthermore, the implication of the department, and its likely target journals, brings with it the necessity to position one's research in the same sphere (if it hasn't already been done during the dissertation stage). That is, leaving methodological preferences aside, to publish in an Organizational Behavior type journal requires at the least a different problem framing compared to, say, an Operations journal.

Also, departments will naturally expect you to teach subjects that are somewhat close to their designation, which means that your teaching duties (in terms of content) will vary significantly between departments. Importantly, you will often have to teach (or at least be willing and able to teach) the department's core courses on its different programs. This, for instance, means that while a positioning and focus on behavioral decision-making may be accepted at many Organizational Behavior departments, the department's core course is likely traditional Organizational Behavior, possibly offering a more decision-focused course yet only as an elective.

Choosing a job at a department that seems like a good fit for a candidate's preferences is therefore not a minor decision. All that being said, where can I find specific job offers to get an idea of concrete teaching

(content) requirements and differences in preferred journal outlets, etc.? There are many job placement services, websites and associations (e.g. the INFORMS' Career Center, the listings by the Society for Risk Analysis, the American Economic Associations JOE site, the AOM Career Center, Akadeus.com – and last but not least this very newsletter!) and to review them is beyond our scope. Yet roaming through their offers reveals possible opportunities for decision analysts, many housed at non-DA departments with very distinct respective implications.

Whilst we have only talked to those working in business school environments, the move from a business school to a non-business school environment or vice versa may also bring with it certain challenges. Again, the issue and consequences of favored publication outlets may arise, as do of course other employment relevant topics such as possible benefits and tenure procedures that are however somewhat independent of the choice of academic field or department.

In that sense, much can be done and it seems there are great opportunities for decision analysts given an open mind, some creativity and persistence. Thinking through these issues well ahead of time will however likely prove to be a good decision.

We thank those who offered valuable insights to this piece and provided examples and guidance. If you have a response to this piece, or if you have further ideas or questions that you would like us to deal with in future Ask DAS columns, please just send us an email (ffederspiel.phd2014@student.ie.edu).

Also, we are currently looking for someone who is interested to contribute as a co-editor to the Ask DAS column. If you are, or know someone that is, please get in touch with us!

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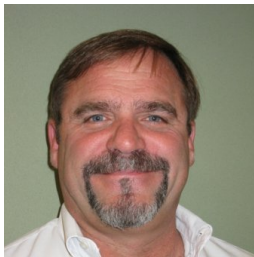
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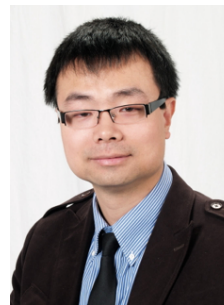
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