

From the Editors

Probability Approximations, Anti-Terrorism Strategy, and
Bull's-Eye Display for Performance Feedback

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This "From the Editors" column is coauthored by new Editor-in-Chief Rakesh K. Sarin and former Editor-in-Chief L. Robin Keller. Our first two articles are on techniques for approximating probability distributions. The first article, by Robert K. Hammond and J. Eric Bickel is on "Reexamining Discrete Approximations to Continuous Distributions." Next, Luis V. Montiel and J. Eric Bickel present a method for "Approximating Joint Probability Distributions Given Partial Information." The next two articles present methods for analyzing terrorist threats or measures for terrorist protection. Kevin Ni, Daniel Faissol, Thomas Edmunds, and Richard Wheeler present a new method for "Exploitation of Ambiguous Cues to Infer Terrorist Activity." The next article is on "Passenger Profiling and Screening for Aviation Security in the Presence of Strategic Attackers" by Huseyin Cavusoglu, Young Kwark, Bin Mai, and Srinivasan Raghunathan. Our final paper is on "WholeSoldier Performance Appraisal to Support Mentoring and Personnel Decisions," by Robert A. Dees, Scott T. Nestler, and Robert Kewley.

Key words: decision analysis; airport security; ambiguous information; analytic center; applications: military; Bayesian analysis; configuration; decision support; dynamic programming; event tree; faking; incomplete information; inspection; maximum entropy; mentoring; national security; nuclear counter-terrorism; passenger profiling; Pearson distribution; performance appraisal; personnel decisions; probabilistic dependence; probability discretization; screening devices; sequential exploration; stochastic optimization; subjective probability; Swanson-Megill; value-focused thinking; editorial

Our opening quote is dedicated to our authors:

*I have made this [letter] longer than usual,
Only because I have not had the time to
Make it shorter.*

Blaise Pascal (*The Provincial Letters, Letter XVI, 1657*)

We are pleased to celebrate our 10th anniversary year as we begin volume 10 under new Editor-in-Chief Rakesh K. Sarin. Founding Editors-in-Chief Don Kleinmuntz and Robert Clemen led the production of volumes 1–3, and outgoing Editor-in-Chief L. Robin Keller produced volumes 4–9.

The associate editors and regular members of the editorial board¹ have been reappointed to serve for

volume 10. We thank George Wu for completing his term of service as associate editor and for agreeing to continue to serve as a regular member on the editorial board.

Decision Analysis publishes papers on theory, assessment methodologies, experiments, surveys, and applications.² Editorials summarizing the papers in each recent issue, including Keller (2012), Keller et al. (2012), Keller and Kophazi (2012), and Merrick et al. (2012), are available, along with the "About the Authors" section, from our journal's online

board member photos are at <http://www.informs.org/Pubs/DA/Promo-Folder/PHOTOS>.

²We encourage teams who have been honored with the DAS (Decision Analysis Society) Practice Award to prepare papers for the journal. See <http://www.informs.org/Recognize-Excellence/Community-Prizes-and-Awards/Decision-Analysis-Society/DAS-Practice-Award>.

¹See the journal site at <http://www.informs.org/Journal/DA/Editorial-Office> for contact information and photos of the editorial office team, including new production editor Kara Tucker. Editorial

site.³ Past issues are archived by HighWire Press®, which also offers the option to request free *Decision Analysis* eTOCs (e-mailed Table of Contents) alerts. Each issue's authors and paper titles are widely disseminated via e-mails to Decision Analysis Society⁴ members, journal news articles in *Decision Analysis Today: The Newsletter of the INFORMS Decision Analysis Society*⁵ and postings on the Decision Analysis Web forum.⁶ A flyer promoting the journal is distributed at conferences and readers are encouraged to distribute it among their colleagues.⁷

Decision Analysis, covered by the Social Science Citation Index since volume 6, has an impressive impact factor⁸ of 2.143 in the management category, ranking it in the top 25%, at 38 out of 166 journals. For all the journals (including all INFORMS journals) that are hosted on the HighWire site that holds our archives, see the rankings of *Decision Analysis* papers which are most often cited and most often downloaded,⁹ based on citations to online articles from HighWire-hosted articles only, not all citations from any works published anywhere.

Our first two articles, by researchers at the University of Texas at Austin, examine existing techniques and propose new ones for approximating probability distributions. Such approaches are important tools for decision analysis practitioners.

The first article, by Robert K. Hammond and J. Eric Bickel is titled "Reexamining Discrete Approximations to Continuous Distributions." For practical applications, it is common to approximate a continuous probability distribution by a discrete distribution, for ease of calculation and, perhaps, to also enhance managerial communication and understanding. Hammond and Bickel (2013) consider a wider range of

continuous distribution shapes than considered previously and then examine the accuracy of existing and new discretization methods.

Next, Luis V. Montiel and J. Eric Bickel present a method for "Approximating Joint Probability Distributions Given Partial Information." Montiel and Bickel (2013) propose new methods and compare them to the use of maximum entropy. They then quantify the methods' accuracy on an illustrative example. A prior paper in *Decision Analysis* by this research team is Montiel and Bickel (2012) on a simulation procedure that can create a collection of possible joint probability distributions to match known probabilistic information

Bickel's other prior papers on probabilities in *Decision Analysis* include Bickel (2007, 2010) on probability scoring rules. He has also published in *Decision Analysis* on using baseball examples in teaching (Bickel 2009), optimal sequential exploration (Bickel and Smith 2006), the value of information (Bickel 2008), and corporate risk aversion (Bickel 2006). Bickel also serves the journal as an associate editor.

Prior *Decision Analysis* papers on probability assessment by other authors include Abbas et al. (2008), Baillon (2008) on using exchangeable events, Bordley (2011) on updating probabilities based on outcomes of partially similar events, and Bordley (2009) on experts who partition events differently. Kilgour and Gerchak (2004), Johnstone (2007), and Schervish et al. (2009) have published papers in *Decision Analysis* on probability scoring rules, used to judge the accuracy of assessed probabilities.

The next two articles present methods for analyzing terrorist threats or measures for terrorist protection. First, Kevin Ni, Daniel Faissol, Thomas Edmunds, and Richard Wheeler examine the "Exploitation of Ambiguous Cues to Infer Terrorist Activity." Ni et al. (2013) provide an example of an adversary who might use sea transportation to move a weapon. In such a case, if a suspected terrorist group is reported to have bought a boat, that would be a cue that such a terrorist activity might occur. But, the terrorist group could get a boat from a different source, or could use a purchased boat for a different reason. So, the cue is ambiguous. Building on a Bayesian statistical approach using ambiguous cues for updating prior beliefs about adversary activity, Ni et al. (2013) use

³ Journal archives: <http://da.journal.informs.org/>. The old *Decision Analysis* website at <http://da.pubs.informs.org> now resolves to <http://www.informs.org/Journal/DA>.

⁴ See <http://www.informs.org/Community/DAS>.

⁵ See <http://www.informs.org/Community/DAS/Newsletter>.

⁶ See <http://www.syncopation.com/forums/viewforum.php?f=7>.

⁷ See <http://www.informs.org/Community/DAS/Decision-Analysis-Journal-for-the-Decision-Analysis-Flyer>.

⁸ See http://thomsonreuters.com/products_services/science/science_products/a-z/journal_citation_reports/.

⁹ See <http://decision.highwire.org/reports/most-read> and <http://decision.highwire.org/reports/most-cited>.

an example of a nuclear terrorist attack on the United States to demonstrate their method.

Our second article related to terrorism in this issue is by Huseyin Cavusoglu, Young Kwark, Bin Mai, and Srinivasan Raghunathan, titled “Passenger Profiling and Screening for Aviation Security in the Presence of Strategic Attackers.” In the United States, the Transportation Security Administration is responsible for screening air passengers to protect against attackers. A passenger profiling system could identify attributes of potential attackers and allow more extensive screening of those people. However, attackers could exploit such a system by changing (i.e., “gaming”) their perceived attributes or behavior. Cavusoglu et al. (2013) examine a no-profiling case and two profiling cases, based on total expected security cost, inspection rate of normal passengers, and attacker detection rate. They find that each of the screening alternatives has different desirable properties. They also find that the benefit from profiling increases if the profiler becomes less vulnerable to gaming by the attacker.

A prior related paper in *Decision Analysis* by two of these authors is Cavusoglu and Raghunathan (2004) on the configuration of detection software, which is related to Ulvila and Gaffney (2004) on computer intrusion detection.

There has been a string of papers in *Decision Analysis* on terrorism detection and national security using game theory or decision analysis methods. Using game theory, Haphuriwat et al. (2011) modeled terrorist decision making to examine nuclear detection technologies, extending prior cargo screening work by Merrick and McLay (2010), and Samuel and Guikema (2012) examined “Resource Allocation for Homeland Defense: Dealing with the Team Effect.” Other terrorism transportation risk papers include Bakir (2008) on cargo screening, von Winterfeldt and O’Sullivan (2006) on surface-to-air missile attacks, and Barrett (2010) on chlorine truck attacks. Other articles dealing with terrorism are Caswell et al. (2011) on a strategy to deter a country from nuclear weapon acquisition, Feng and Keller (2006) on potassium iodide distribution after a nuclear incident, and Hausken and Zhuang (2011) on governments’ and terrorists’ choices between attacking the enemy and defending against an attack. Additional prior game theory

papers in *Decision Analysis* include van Binsbergen and Marx (2007), Cobb and Basuchoudhary (2009), Lippman and McCardle (2004), and Rothkopf (2007).

The final paper in this issue presents a new method based on an additive multiple attribute value function for tabulating and visually communicating human resource performance evaluations. In “WholeSoldier Performance Appraisal to Support Mentoring and Personnel Decisions,” Robert A. Dees, Scott T. Nestler, and Robert Kewley develop their model and show the resulting application for junior enlisted soldiers in the Army. Soldiers are evaluated by supervisors on attributes under the moral, physical, and cognitive domain categories. Their results are visually displayed in a novel bull’s-eye target pattern that can be used to provide performance feedback and mentoring on areas needing improvement. Performance nearer to the bull’s-eye on an attribute is better. A prior related paper by Dees in *Decision Analysis* is Dees et al. (2010), on a decision-focused transformation of additive value models to improve communication.

A prior paper in *Decision Analysis* on a United States military application is Ewing et al. (2006) on military base realignment and closure decision making. In another *Decision Analysis* paper, performance evaluation by strangers plays a role in determining a jointly shared reward. Carvalho and Larson (2012) proposed a mechanism, using a peer-prediction method built upon strictly proper scoring rules, which rewards people based on how others evaluate them, and based on how truthful they are in evaluating others.

Papers in *Decision Analysis* related to practice include a survey in Keefer et al. (2004) and Keisler and Noonan (2012) on communication practices in decision analysis consulting. Other works on decision analysis applications include Cantor (2004) on medical decision analysis, Bana e Costa et al. (2008) on electricity transmission, Brothers et al. (2009) on radioactive liquid process waste, Brown (2009) and Gregory et al. (2005) on public policy, Ewing and Baker (2009) on green buildings, McCardle et al. (2009) on fundraising, Mild and Salo (2009) on resource allocation, and Sevillano et al. (2012) on avoiding pirates.

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