## From the Editor

# Multiattribute and Intertemporal Preferences, Probability, and Stochastic Processes: Models and Assessment

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O ur first article, by Jay Simon and Francois Melese is on "A Multiattribute Sealed-Bid Procurement Auction with Multiple Budgets for Government Vendor Selection." Next, Ali E. Abbas develops "The Multiattribute Utility Tree." In our third article, Thomas W. Keelin and Bradford W. Powley introduce a method for encoding uncertainty on a continuous variable using "Quantile-Parameterized Distributions." Next, Warren J. Hahn and James S. Dyer present "A Discrete Time Approach for Modeling Two-Factor Mean-Reverting Stochastic Processes." The final article is by Jeffery L. Guyse and Jay Simon on "Consistency Among Elicitation Techniques for Intertemporal Choice: A Within-Subjects Investigation of the Anomalies."

*Key words*: decision analysis; affordability; anomalies; continuous probability distribution; decision trees; defense acquisition; discounting; discrete models; dynamic programming; interpolation independence; multiattribute auctions; multiattribute utility; probability encoding; procedure invariance; public procurement; quantile function; risk aversion; stochastic processes; time preference; utility independence; valuation; vendor selection; editorial

We begin this column with a song parody, created by David Matheson and Ward Edwards for the dinner banquet at the "Utility: Theories, Measurements and Applications" Conference, which was organized by Ward Edwards in Santa Cruz, California, in June 1989. Normative, prescriptive, and behavioral decision researchers attended the conference and discussed expected utility theory and generalized expected utility (G.E.U.) theories, such as prospect theory, which relax axioms required by expected utility or subjective expected utility (S.E.U.).

*Battle Hymn of S.E.U.*

*Mine eyes have seen the glory of the norms called S.E.U.*
*They capture rationality, the finest thing to do.*
*The people who adhere to them are winners through*
  *and through;*
*Substi-tu-ta-bil-i-ty*

*Through experiment we ramble*
*Always picking the right gamble*
*That is only the preamble;*
*Ra-tio-na-li-ty!*

*Alternative, decision, uncertainty, and chance.*
*We list and then elicit from our clients at a glance.*
*Our values cover everything from money to romance;*
*Trans-i-ti-vi-ty!*

*The first effort is a bushy mess*
*Then we realize we can do with less*
*Simple structures are by far the best*
*Ra-tio-na-li-ty!*

*Our client meets an analyst professing GEU:*
*Weakening the axioms is the trendy thing to do.*
*The client sees the light so rationality wins through;*
*In-de-pen-den-cy!*

*For each and every number*
*In the night while others slumber,*
*The bushy tree we disencumber;*
*Ra-tio-na-li-ty!*

*Rolling back the tree asserts the option A is best*
*But the client says it fails the cla-arit-ty test*
*He commits to it because our program does the rest*
*Mon-o-toni-ci-ty!*

*Glory, glory rationa-lity!*
*Glory, glory, that's the way to be!*
*The old-time religion is the best for me;*
*SEU is rationa-lit-y!*

Parody of *Battle Hymn of the Republic* by
David Matheson and Ward Edwards[1]

Four of the papers in this issue are on the normative and prescriptive side of decision analysis, discussing multiattribute preference models, probability assessment, and stochastic processes modeling. One paper describes biases in intertemporal preferences.

Our first article, by Jay Simon and Francois Melese, is on "A Multiattribute Sealed-Bid Procurement Auction with Multiple Budgets for Government Vendor Selection." One of the typical problems that government purchasing agents face is selecting a vendor who will provide goods or services that can be described on a number of attributes. Simon and Melese (2011) present a novel idea of having vendors prepare a set of alternatives over different budget levels, with each alternative specifying which combination of performances on the attributes will be provided within its budget limit. A multiattribute first-price, sealed-bid procurement auction is proposed for the case of a decision under certainty, and then extended for the buyer's decision problem under budget uncertainty by using a utility function assessed over the value measure.

Other related papers in *Decision Analysis* on multiple attribute decision models include Merrick et al. (2005) on watershed improvement and Mild and Salo (2009) on infrastructure maintenance. Bordley et al. (2010) previews the set of papers on auctions in the special issue in honor of Michael Rothkopf, including Chen et al. (2010) on contingent contracts in procurement auctions, Shachat and Swarthout (2010) on

[1] A set of song parodies was created by the researchers at the conference. This song text and the one in the trivia question later in the column are from personal correspondence from the late Tulane professor Irving H. LaValle, dated September 27, 1989. As the founding newsletter editor (from 1981 to Spring 1996), Irv published the talk abstracts from the conference in the December 1989 *Newsletter* of the ORSA Special Interest Group on Decision Analysis (the predecessor to the Decision Analysis Society of INFORMS). The songs may have appeared there also; I do not have access to a copy anymore to confirm this. More recent newsletters are at http://www.informs.org/Community/DAS/Newsletter.

procurement auctions for differentiated goods, Hoffman and Menon (2010) on a practical combinatorial clock exchange for spectrum licenses, Abbas and Hann (2010) on risk aversion in a name-your-own-price channel, and Boatwright et al. (2010) on common value versus private value online auctions. In addition to his contributions as an author, including Guyse and Simon (2011) in this issue, Dr. Simon also provides leadership to the journal as a member of the editorial board.

Next, Ali E. Abbas develops "The Multiattribute Utility Tree." Abbas (2011b) creates a tree display that divides the von Neumann–Morgenstern utility of a multiattribute consequence into a sum of products of indifference probability assessments of binary gambles, thus portraying a sequence of gambles that can be used to elicit the utility value of a consequence. New independence concepts including "boundary independence" and "corner independence" are also developed.

Other related papers in *Decision Analysis* by Dr. Abbas include Abbas (2011a) on decomposing the cross derivatives of a multiattribute utility function into risk attitude and value, Abbas and Howard (2005) on attribute dominance utility, and Abbas (2007) on invariant utility functions. Other related prior papers in *Decision Analysis* include Dees at al. (2010) on additive multiattribute value functions and Denuit and Eeckhoudt (2010) on bivariate stochastic dominance and substitute risk-(in)dependent utilities. Additional prior contributions to *Decision Analysis* by Dr. Abbas include Abbas (2009) on linear and log-linear pools of experts' judgments, Abbas et al. (2008) on probability encoding methods, and Abbas and Aczél (2010) on functional equations. In addition to his contributions as an author, Dr. Abbas also provides leadership to the journal as an associate editor; see Keller et al. (2010).

In our third article, Thomas W. Keelin and Bradford W. Powley introduce a method for encoding uncertainty on a continuous variable using "Quantile-Parameterized Distributions." First, Keelin and Powley (2011) introduce a new class of continuous probability distributions that are parameterized by a set of quantiles—a typical output from a probability elicitation procedure or a probabilistic simulation. Then,

the authors illustrate the flexibility and applicability of these distributions.

Prior papers in *Decision Analysis* on probability elicitation and probabilities include Bordley (2011) on updating an event's probability based on the outcomes of partially similar events; Bordley (2009) on combining the opinions of experts who partition events differently; Abbas et al. (2008) on two probability assessment methods; Baillon (2008) on a method for eliciting probabilities using exchangeable events; and Bickel (2010), Johnstone (2007), Kilgour and Gerchak (2004), and Schervish et al. (2009) on probability scoring rules. Additional papers on combining probabilities from assessors include Wang et al. (2011) on aggregating large sets of probabilistic forecasts by weighted coherent adjustment, which is a follow-up to Predd et al. (2008) on aggregating probability assessments from incoherent or abstaining experts, and Merrick (2008) on getting the right mix of experts.

Next, Warren J. Hahn and James S. Dyer present "A Discrete Time Approach for Modeling Two-Factor Mean-Reverting Stochastic Processes." Intertemporal dynamics of commodity prices or other similar variables can be modeled by two-factor stochastic processes. Hahn and Dyer (2011) show how to model such processes in discrete time as two-dimensional binomial sequences, to enable numerical solution of dynamic optimization problems. They apply their approach, using a two-dimensional lattice format, to two valuation problems in Schwartz and Smith (2000).

Other related papers in *Decision Analysis* include Brandão et al. (2005a, b) on using binomial decision trees to solve real-option valuations, Smith (2005) on alternative methods for solving real-options problems, and Wang and Dyer (2010) on how to value multifactor real options using an implied binomial tree. Another prior paper in *Decision Analysis* by Dr. Dyer is Butler et al. (2006) on using attributes to predict objectives in preference models. In addition to their contributions as authors, Drs. Hahn and Dyer also serve as members of the editorial board.

The final article is by Jeffery L. Guyse and Jay Simon on "Consistency Among Elicitation Techniques for Intertemporal Choice: A Within-Subjects Investigation of the Anomalies." Guyse and Simon (2011) report the results of an experiment in which participants made preference judgments about monetary outcomes occurring at different points in time, using both sequences of outcomes and paired comparison matching judgments. With both sequences and matching judgments, preferences do not always obey the normative discounting model's prescriptions. For example, with sequences, a person can express a preference for spreading out monetary outcomes over time, which cannot easily be observed when giving judgments involving only two points in time. Guyse and Simon's (2011) participants displayed such a preference for spreading losses when they were presented with sequences. Finding significantly more consistency between the two methods when the outcome is a future gain than when it is a future loss, Guyse and Simon (2011) posited that this may be due to the participants' inability to display a preference for spreading losses in the matching task.

In a prior paper, Guyse et al. (2002) examined preferences for sequences of outcomes over time for environmental outcomes and found a preference for constant or increasing sequences, among sequences with the same overall average level, counter to the normative prescription of discounted utility, which would prescribe a preference for decreasing sequences. Also by Dr. Simon in *Decision Analysis* is Simon and Melese (2011) in this issue. Drs. Guyse and Simon also serve on the editorial board of *Decision Analysis*.

Next year, we anticipate publishing a special issue of *Decision Analysis* on "Games and Decisions in Reliability and Risk," with guest editors Refik Soyer, Fabrizio Ruggeri, and Jason Merrick. We have received quite a few submissions for the special issue, and they are currently under review. The focus of the special issue is on the use of game theory and decision theory in reliability analysis and risk analysis. See Keller et al. (2011) for the Call for Papers.

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Now it is time for our *Trivia question* on another song from the 1989 conference in Santa Cruz organized by Ward Edwards. Chew Soo Hong wrote a parody of the song "Yesterday" by the Beatles:

*Yesterday, life was such an easy game to play.*
*Now my plans are in such disarray.*
*Oh, I believe in yesterday!*

*Suddenly, utility is not what it used to be.*
*I hope that I'll maintain consistency.*
*I believe in rationality.*

*Why she had to go I don't know, she wouldn't say.*
...

What is the missing last line in Chew's song?
   A. *I said something wrong, now I long for yesterday.*
   B. *Now I need a place to hide away.*
   C. *I said the theory's wrong, now I long, for yesterday!*
   D. *Love was such an easy game to play.*
   E. *At least new theories can fit in our song, anyway.*
See the footnote for the trivia answer.[3]

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[2] http://www.informs.org/Find-Research-Publications/INFORMS -Journals/Author-Portal/Publications-Policies/Guidelines-for-Copyright-Plagiarism for more information.

[3] *Trivia answer:* C. *I said the theory's wrong, now I long, for yesterday!* Chew Soo Hong was one of the earliest to develop a theory relaxing expected utility theory, weighted utility theory; see Chew and MacCrimmon (1979) and Chew and Waller (1986). (See also Chew et al. 1987, Chew and Epstein 1989, Chew et al. 1993, Chew and Karni 1994.)

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