DECISION-ANALYSIS NEWSLETTER

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Editor's Note

This large issue of the Newsletter brings us up to date on SIG activities, including elections, meetings, establishment of prizes, and abstracts of recent technical reports and working papers.

The fact that not more abstracts are included after our extraordinarily long publication hiatus probably implies that not too many of you are sending copies to me. The only requirements for our publishing an abstract of your work are:

(1) That the paper itself be available for distribution upon request; and (2) That the abstract not exceed 200 words by much.

If there is a charge, please so indicate when you send you paper to:

Irving H. LaValle
A.B. Freeman School of Business
Tulane University
New Orleans, LA 70118.
(O)(504) 865-5484
(H)(504) 899-8110

Please phone or write in any changes in your activities or employment that could be of interest to our membership!

Announcements

Dr. Martin Talcott, formerly Head of Psychological Sciences Division, ONR, has joined the staff of Decision Science Consortium [7700 Leesburg Pike, Suite 421, Falls Church, VA 22043] as a Senior Scientist.

By now, Ralph Keeney should have returned to California after

(cont. pg 2)

Howard Raiffa Awarded First Frank P. Ramsey Medal

At the Boston meeting last Spring, Howard Raiffa of Harvard University became the first recipient of the Frank P. Ramsey medal, awarded by ORSA. SIG Chairperson David Bell introduced the award at the luncheon ceremony on Tuesday, April 30:

"The Operations Research Society Special Interest Group on Decision Analysis was started four years ago, and now has over 600 members. We have introduced an annual award to be known as the Frank P. Ramsey Medal, to honor people who have made distinguished contributions to the field of Decision Analysis.

"In addition to the medal, Decision Science Consortium has generously agreed to provide the winner with a check for $1,000. Rex Brown, chairman of the board is here to make that presentation."

Dr. Rex Brown then presented the award:

"The SIG Council was unanimous in selecting Howard Raiffa as the first recipient of the medal. His books, starting in 1957, such as Games and Decisions, Decision Analysis, Decisions with Multiple Objectives and, most recently, The Art and Science of Negotiation (1982), have had a profound influence on the field.

"More than that, Howard Raiffa has been an inspiration to hundreds who have been his students including the many dozens who have written dissertations under his supervision .

"This award, Howard, is an attempt to say Thank You."

(cont. pg. 2)

Announcements (cont.)

spending the autumn at the Univ. of Passau (Germany).

For most of this Spring, Donald A. Wehrung will be at the Jesse H. Jones Graduate School of Administration, 306 Herring Hall, Rice University, P. O. Box 1892, Houston, TX 77251.

Elisabeth Pate'-Cornell of Stanford and Randy Simpson of ONR have been elected to the SIG Council, replacing Robin Hogarth and John Lathrop.

Future Meetings

Charles Harvey has organized an outstanding slate of 12 Decision Analysis sessions for the Los Angeles TIMS/ORSA meeting (April 14-16, '86), including state-of-the-art presentations by Professors Ronald A. Howard and David Kahneman.

Samuel E. Bodily is arranging for the Decision Analysis sessions at the Miami ORSA/TIMS meeting (Nov. 3-5, '86).

Irving LaValle is arranging for the sessions at the Spring '87 TIMS/ORSA meeting in New Orleans. [See Editors Note for address], and Robert F. Bordley is doing the same for the Fall '87 ORSA/TIMS meeting in Kansas City [See attachment for address].

Recent Books

Two recent and significant books of interest to many SIG members include Modern Decision Making: A Guide to Modeling Systems, by Samuel E. Bodily, McGraw-Hill, 1985 (an instructors' manual is available), and Taking Risks: the Management of Uncertainty, Kenneth R. MacCrimmon and Donald A. Wehrung, Free Press, 1986.

Decision Analysis Prizes

At the Dallas membership meeting, the SIG enacted four prizes for contributions to the area.
(cont. pg 3)

Raiffa (cont.)

Professor Raiffa's acceptance saluted the remarkable versatility and persistence of his long-time colleague, Robert O. Schlaifer:

"In 1957, I moved from Columbia University where I taught mathematical statistics to take up a joint appointment at Harvard between the newly created statistics department and the Business School. I had absolutely no interest in business at the time but there I met a most remarkable man, Robert Schlaifer, who influenced my intellectual development more than any other individual -- more than Abraham Wald or von Neumann or Savage or Arrow. Robert was trained as a classical Greek historian and he happened to be teaching statistics at the Business School because no one else was available at the time to teach it. His sole training was a single course in calculus. We worked closely together for about 7 years and I always thought of him as the intellectual leader and driving force of our productive relationship.

"I was a trained statistician and game theorist. I could read the literature. All Robert had was a razor-sharp intellect and a dogged determination to lay to rest every little detail; it was he who had the courage to start every problem from scratch. Our paths diverged after we wrote a couple books together, he to remain devoted to a limited class of problems, and I to roam over a broader domain. I am honored deeply by the award you have given me today but I would feel uncomfortable accepting it without also paying tribute to my mentor, Robert Schlaifer, who will continue to produce indefatigably despite his imminent official retirement. Thank you."

[Editor's note: Based on my visit to Harvard in August, I
(cont. pg 3)

Prizes (cont.)

The Frank P. Ramsey Medal, to be awarded for outstanding contributions to Decision Analysis over the recipient's career to date. To be awarded irregularly but not more frequently than annually.

The Decision Analysis Applications Award, for an outstanding application of Decision Analysis. To be awarded every other year commencing with the Spring of 1987. A nominating committee will solicit self-nominations consisting of a four-page summary of the project, and select not more than ten finalists, and schedule two back-to-back sessions in which the projects are presented and judged by the Council. Note: to avoid unfair competition due to CPMS tutoring, a project in the CPMS finals cannot be a candidate for the Decision Analysis Applications award in the same year.

The Decision Analysis Theory Award, for an outstanding contribution to basic theory underlying Decision Analysis. To be awarded every other year commencing with the Spring of 1988. This award must be based upon an article or book that has appeared in the open, published literature.

The Decision Analysis Student Award, for an outstanding student project in Decision Analysis (theory or application or both). Ordinarily to be awarded annually at the Fall meeting. Candidates should submit papers of approximately 20 pages to a nominating committee, which will select finalisits to present their work in a session at the Fall meeting for judging by the Council. [See accompanying call for submissions.]

Raiffa (cont.)

am happy to report both Howard Raiffa and Robert Schlaifer are indeed producing indefatigably!]

Decision Analysis Seminars

A feature of some of the recent joint national meetings has been the inclusion of a SIG-sponsored session called "Decision-Analysis Seminar"; its intent, as indicated by the standard abstract, is to enable presentation of research that may be very recent, late-breaking, and ongoing, without the delay that inevitably occurs due to bulletin and organizing deadlines. Some papers presented at these seminars include Richard Lund's presentation on the marketing of consulting services in Decision Analysis (Atlanta), Donald Wehrung's presentation of important empirical findings on manager's attitudes toward taking risks (Atlanta), John Lathrop's presentation of a very complete 'meta-tree' model (editor's term, not John's) for choice of weapons system (San Francisco), David Bell's introduction of a profound extension of the class of exponential utility functions (San Francisco), Soo-Hong Chew's presentation of a generalization of weighted-linear utility (Dallas), a justification for cross-entropy minimization in Decision Analysis made by Donald E. Brown and Robert L. Smith of the University of Michigan, and a warning-signal approach to monitoring country risk by Elisabeth Pate'-Cornell.

Call for Nominations: Decision-Analysis Student Award.

Any student who has obtained his or her doctorate in calendar year 1985 or 1986 is eligible (cont. pg 4)

Nominations (cont.)

to compete for the initial Decision Analysis Student Award. The procedure for entering the competition is as follows:

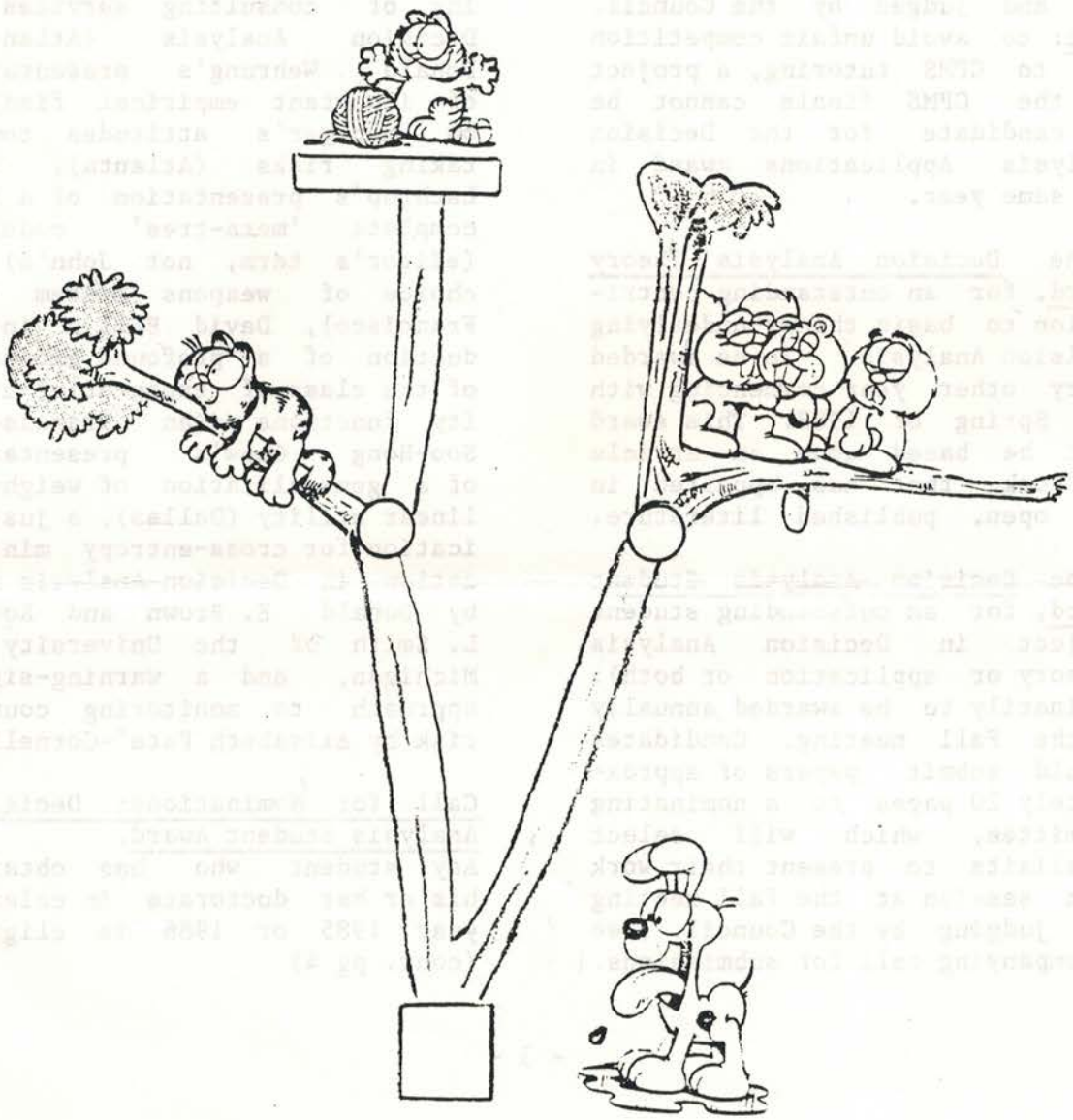
(1) By September 30, 1986, submit a paper of approximately 20 pages to the SIG chairperson:

Dr. Ralph L. Keeney
Systems Science Dept.
Inst. for Safety & Systems Management
Room 101
University of Southern California
Los Angeles, CA 90089-0021

A Committee will then select finalists.

(2) Finalists will present their work for judging by the Council at a session scheduled for the Fall meeting in Miami.

If you know of a promising student who is not likely to read this Newsletter, please duplicate this notice and so inform him or her. Thank you!



From Gordon B. Hazen, Department of Industrial Engineering and Management Sciences, Northwestern University, Evanston, Illinois 60201:

Differential Characterizations of Nonconical Dominance in Multiple Objectives Decision Making.

Suppose a decision maker's preferences are represented by a value function $v(\cdot|\theta)$ indexed by an unknown parameter θ. Prior information concerning θ is available in the form $\theta \in \Theta$ for some specified set Θ. An alternative x is dominated by an alternative y under Θ if $v(x|\theta) < v(y|\theta)$ for each $\theta \in \Theta$, in which case we write $x <_\theta y$. Continuous variable problems are considered, in which alternatives are sought which are undominated under $<_\theta$. Differential conditions of the Kuhn-Tucker type are presented, which characterize undominated solutions. This leads to a scalarization approach for generating undominated solutions. The special case in which $v(\cdot|\theta)$ is the multiplicative measurable value function of Dyer and Sarin is considered. Since $<_\theta$ may be nonconical order, these results are not subsumed by conventional vector optimization. Instead, the results are derived using the nonconical optimality conditions developed by Hazen and Morin.

Partial Information, Dominance, and Potential Optimality in Multiattribute Utility Theory

When a multiattribute utility function is only partially specified by prior preference statements, what can be said about the relative desirability of actual alternatives? This question is addressed for the cases of additively separable cardinal utility with unknown scaling constants, multiplicatively separable cardinal utility with unknown scaling constants, and additively separable ordinal utility. Previous approaches are reviewed. Issues of consistency (is the prior information consistent?), dominance (Does the prior preference information imply that x is preferred to y?) and potential optimality (Are there utility functions of the given form, consistent with prior preference information, under which x is preference optimal?) are treated. In the additive cases, a key relationship between dominance and potential optimality may be derived. An example appli- cation to a well siting study is presented.

From M. Elisabeth Pate'-Cornell, Department of Industrial Engineering - Engineerying Management, Terman 354, Stanford University, Stanford, CA 94305

Probabilistic Assessment of Warning Systems: Signals & Response

A theory is presented here that allows economic evaluation of warning systems and comparison of their efficiency and cost-effectiveness with other means of risk reduction. A method is developed for the probabilistic evaluation of a given warning system, including an assessment (1) of the signals and (2) of human response, given the memory that people have kept up the quality of previous alerts. One of the results is an explicit formulation of the system's benefits. It includes inputs from: a signal model, a loss model, a response model, an evacuation model, a critical threshold model, and a deterioration model. This formulation allows optimization of the warning threshold on the basis of expected costs and benefits of the system.

From Peter H. Farquhar and Yutaka Nakamura, Graduate School of Industrial Administration, Carnegie-Mellon Univeristy, Pittsburgh, PA 15213

Constant Exchange Risk Properties

This paper develops a methodology using risk properties to characterize the functional form of a utility measure for decision making under uncertainty. The constant absolute risk property, for example, is known to be necessary and sufficient under appropriate regularity conditions for the utility function to have either a linear or an exponential form. a new generalization of this property, called the constant exchange risk property, gives a characterization of six utility fuctions: the linear function, the exponential function, the quadratic function, the sum of two exponential functions, the sum of a linear and an exponential function, and the product of a linear and an exponential function. Since all of these functional forms have been used previously as approximations, this methodology allows one to distinguish beforehand between alternative forms and thus properly specify the utility function in applications. The paper concludes with a practical procedure for testing constant exchange risk properties and identfying the appropriate utility representation.

Measures of Multivariate Risk Aversion

This paper introduces two definitions of multivariate risk aversion and proposes four measures of multivariate risk aversion. When multiattribute utility functions with the same ordinal preferences are considered, we show that these four measures are appropriate measures for comparative multivariate risk aversion. Even when ordinal preferences are different from each other, we show that our definition of multivariate directional risk aversion can be applied to comparative risk aversion. Finally, we introduce two definitions of decreasing, constant, and increasing multivariate risk aversion and derive some properties.

From Yutaka Nakamura, Dept. of Precision Engineering, Osaka Univ., 2-1 Yamada-Oka, Fuita, Osaka 565, Japan

Nonlinear Integral for Nonadditive Probability Measure

In this paper, we define the nonlinear (NL) integral for the nonadditive probability (NAP) measure and derive its properties. NAP relaxes the additivity axiom of the probability measure by the monotonicity axiom. NL integral can be represented in various ways. We show two explicit representations of NL integral which reduces to Lebesgue integral when NAP reduces to the probability measure.

From Craig W. Kirkwood, Quantitative Systems Department, College of Bus. Administration, Arizona State University, Tempe, Arizona 85287, and Rakesh K. Sarin, Graduate School of Management, University of California at Los Angeles, Los Angeles, California 90024

Ranking with Partial Information About Attribute Weights, Including an Application to Nuclear Waste Containment Materials Selection

A method is presented for ranking multiattributed alternatives using a weighted-additive evaluation function with partial information about the weighting (scaling) constants, and this method is applied to the evaluation of materials for use in nuclear waste containment. Conditions are derived to determine whether a pair of alternatives can be ranked given the partial information about weighting constants.

set of alternatives based on the pairwise ranking information.

From Douglas M. Logan, Planning and Research Department, Pacific Gas and Electric Company, 77 Beale Street, San Francisco, California 94106

The Value of Accuracy in Probability Assessment for Simple Decision Problems

This paper introduces the concepts of the expected value of perfect assessment (EVPA), the expected value of assessment (EVA), and the expected los relative to perfect assessment (ELRPA). EVPA is the maximum amount that a decision maker should pay for perfect assessment of his state of information in a given decision setting. EVA is the maximum amount he should pay for a particular imperfect assessment. And ELPRA is the difference between EVPA and EVA. The value of imperfect assessment may be negative, although the value of imperfect information is always non-negative.

Formulas are presented for EVPA and ELPRA for a class of problems in which expected utility can be written as a polynomial in the decision variable.

From John W. Pratt and Richard J. Zeckhauser, John Fitzgerald Kennedy School of Government, Harvard University, Cambridge, Massachusetts 02138

Proper Risk Aversion for Individuals and Groups

A utility function on wealth is called proper if an undesirable lottery can never be made desirable by acceptance of an independent, undesirable lottery. (Independent random background wealth is allowed.) Apparently stronger conditions on certainty equivalents and risk premiums are shown to follow. Completely monotone utility functions (mixtures of exponentials) are proved proper. Necessary and sufficient conditions are obtained. Local necessary conditions are derived and their insufficiency domonstrated.

If a group of proper individuals faces two independent lotteries neither of which can be partitioned even nonlinearly into shares acceptable to all, it is proved that no combination of separate shares can be acceptable to all. Moreover, unless all group members' utilities are exponential or power functions with the same power (equal constant relative risk aversions), optimal sharing of multiple lotteries is nonlinear in the combined lottery, and lotteries exist whose Pareto frontiers cross. This makes the group risk seeking in the sense that it may desire a randomized selection between individually undesirable lotteries.

From Carson E. Agnew, Engineering-Economic Systems Department, Stanford University, Stanford, California 94305

Calibration of Subjective Point Estimates

An assessor provides point forecasts of the expected values of a sequence of random variables, and observes the realization of each random variable in the sequence before making the next fore- cast. If the successive point estimates obey the properties of an expected value, conditional on past forecasts and outcomes, then it is shown that suitably defined "forecast errors" exist which have zero mean value and are mutually uncorrelated. Consequently, the point estimates themselves are unbiased estimates of the variable being forcast.

Moreover, if the sequence of random variables converges to a long run average then the average of the assessments also converges. These results are analogous to "calibration" theorems for probability assessments. The similarities and implications of these results are discussed.

Bayesian Consensus Forecasts of Macroeconomic Variables

Economists, like other forecasters, share knowledge, data and theories in common. Consequently, their forecast errors are likely to be highly dependent. This paper reports on an empirical study of 16 macroeconomic forecasters. Composite forcasts are computed using a sequential weighting scheme that takes dependence into account; these are compared to a simple average and median forecasts. A within-sample composite is also calculated. Both these methods do significantly better than the average or the median. This is apparently because the degree of dependence between the forecasters' errors is so high that the optimal composite forecasts should lie outside the range of the individual forecasts.

From Charles M. Harvey, Dickinson College,Carlisle, PA 17013

Value Functions for Infinite-Period Planning

Cost-benefit and risk analysis studies that model tradeoffs between the present and the distant future by means of present value discounting have been criticized for according the future, and thus future generations, far too little importance. This paper presents an alternative means of modeling tradeoffs between different periods that accords the future far more importance than present value discounting, and that is no more difficult to apply. The paper also presents a means of modeling the preference issue of concern for equity or stability between different periods.

Utility Functions for Infinite-Period Planning.

This paper presents a systematic discussion of decision analysis models for attitudes toward risk when the effects of a public policy choice extend into the distant or unbounded future. Several issues of social risk attitudes are identified and discussed. Conditions on preferences are presented by which value judgments concerning these issues can be included in a formal model for a public policy evaluation.

A Preference Model for Averse-Prone Risk Attitudes

This paper proposes an explanation and a model for the tendency of many decision makers to be risk averse in their preferences among actions leading to net gains or the status quo but to be risk prone in their preferences among actions leading to net losses or the status quo. It is suggested that for a person having such an avers- prone risk attitude, the consequences can be more realistically described by including additional attributes for the psychological effects of financial outcomes, e.g., effects on the decision maker's self-esteem and reputation. A preference model is described that relates an attitude of risk aversion for gains and losses in a context in which these psychological effects are omitted to an averse-prone risk attitude in a context in which these psychological effects are present.

From Hillel J. Einhorn and Robin M. Hogarth, Center for Decision Research, Graduate School of Business, University of Chicago, 1101 East 58th Street, Chicago, IL 60637

Ambiguity and Uncertainty in Probabilistic Inference

Ambiguity results from having limited knowledge of the process that generates outcomes. It is argued that many real-world processes are perceived to be ambiguous; moreover, as Ellsberg (1961) demonstrated, this poses problems for theories of probability operationalized via choices amongst gambles. A descriptive model of how people make judgments under ambiguity is proposed. The model assumes an anchoringand-adjustment process in which an initial estimate provides the anchor, and adjustments are made for "what might be." The latter is modeled as the result of a mental simulation process that reflects two factors: (1) the degree of perceived ambiguity, which affects the amount of the simulation; and, (2) the person's attitude toward ambiguity, which affects the extent to which imagined probabilities are differentially weighted. A two-parameter model of this process is shown to be consistent with: Ellsberg's original paradox, the non-additivity of complementary probabilities, current psychological theories of risk, and Keynes' idea of the "weight of evidence." The model is tested in four experiments involving both individual and group analyses. In experiments 1 and 2, the model is shown to predict judgments quite well; in experiment 3, the inference model is shown to predict choices between gambles; experiment 4 shows how buying and selling prices for insurance are systematically influenced by one's attitude toward ambiguity. The results and model are then discussed with respect to: (1) the importance of ambiguity in assessing uncertainty; (2) the use of cognitive strategies in judgments under ambiguity; (3) the role of ambiguity in risky choice; and, (4) extensions of the model.

From David E. Bell, Harvard Business School, Boston, MA 02163

Double-Exponential Utility Functions

Utility functions for wealth may be assessed graphically but care must be taken to ensure that desirable properties such as decreasing risk aversion are maintained. It is also computationally desirable to produce a utility function expressable in closed form, examples being $u(x) = c \exp(cx)$, $\log(x+c)$ or $(x+c)^b$. We introduce and motivate a new family $u(x) = -\exp(b \exp -cx)$ which we call double-exponential.

This functional form arose from a study of assessment procedures for multiattribute utility functions, whose object was to identify a class of decompositions for which conditional utility functions were always of the same parametric family. One result of this research is a new multiattribute decomposition $u(x,y) = c \exp(cv(x)w(y))$ that generalizes the multiplicative decomposition in the same way that the multiplicative generalizes the additive, namely by raising the form as an exponent. The practical implication of this paper is that research effort should be directed towards developing interview techniques that encourage discovery of a set of ordinally-additive attributes to describe a decision maker's objectives.

From Richard Engelbrecht-Wiggans, College of Commerce and Business Administration, University of Illinois at Urbana-Champaign, Urbana, IL 61801

Optimal Competitive Contracting

By simultaneously considering both the auction and contract design aspects of competitive contracting we discover that optimal competitive contracting may require substantially more cost or production sharing than can simply be attributed to any need for risk sharing. The paper starts by reviewing the basic issues in each of the auction and contracting literatures, using a simple example to illustrate. We then solve the example explicitly to substantiate the intuition developed in the previous sections. Finally, the second part of the paper proposes a formal model of competitive contracting and then uses this model to formally show that the phenomena exhibited by the example occur far more generally.

Optimal Auctions: The Role of Information

This paper presents a model of competitive bidding that explicitly parameterizes how the expected price paid by each bidder depends on other bidders' information. Varying this parameter, yields a family of auction mechanisms--a family we call regret-free because no bidder would ever want to have bid differently even if he had known, at the time of bidding, all the information on which his payments would be based. This family includes many, if not most, auction mechanisms observed in practice; the family excludes many mechanisms suggested by the literature as good mechanisms, but rarely if ever used in practice.

The model not only defines an interesting class of mechanisms, but also allows for the simultaneous study of all mechanisms within the class. To illustrate, by solving a single direct revelation game, Theorem 1 explicitly characterizes the bidders' expected payments as a function of the model's parameters. By varying the parameters in this solution, Theorem 2 unifies a variety of results on the role of information previously obtained through a variety of mechanisms. Together, these theorems demonstrate the potential of the model in better understanding the role of information in auctions.

From Kenneth R. MacCrimmon and Donald A. Wehrung, Faculty of Commerce and Business Administration, University of British Columbia, 2053 Main Mall, Vancouver, B.C. V6T 1Y8

Characteristics of Risk-Taking and Risk-Averting Top Executives

Willingness to take risks was related to the personal, financial, and business characteristics of over 500 top-level managers. Common stereotypes of risk-taking chief executive officers, risk-averse bankers, and increasing risk-aversion with age were supported by a wide range of risk measures drawn from standardized situations, revealed choices, and attitudes. Other stereotypes concerning the relationship between risk and wealth, income, success, seniority, and dependents were partially supported, but depended on which risk measure was chosen. Contrary to expectations, we found a positive relationship between education level and taking risks and no clear results for firm size or industries other than banking.

From **Ross D. Shachter**, Department of Engineering-Economic Systems, Stanford University, Stanford, CA 94305

Joint Risk Aversion and the Economics of a Difference of Opinion

Two agents agree to share an uncertain payoff. Each has a subjective probability distribution and a utility function which is state-dependent. They are jointly risk averse if all Pareto optimal sharing rules are independent of some irrelevant event, such as a coin flip. When a principal and an agent are jointly risk averse, a reward can be constructed for the agent's probability assessment which not only encourages honest revelation of both the agent's probabilities and utility function, but the agent also prefers to introduce more refinement whenever such detail exposes disagreement.

From P. L. Yu, School of Business, Universtity of Kansas, Lawrence, KA 66045

Behavior Mechanism in Decision Making

A dynamic micro mechanism of human behavior is sketched with some macro observations of behavior patterns. The concept of habitual domains is then introduced. We discuss the formation of stable habitual domains and methods of expanding our habitual domains. The implications and applications of the concepts of habitual domains to high stake decision problems, optimality/rationality, conflict resolution, career management and leadership are also sketched.

A Verification Theorem of Preference Separability for Additive Value Functions. (With E. Takeda, Dept. of Management Science, Kobe University of Commerce, Tarumi, Kobe 655, Japan

This paper offers an operational verification theorem of preference separability for additive value functions. Additive covering of the attribute index set plays a key role in the derivation. Effective ways for utilizing the theorem to derive additive value functions in terms of orthogonal square designs and progressive ways to determine the form of value functions are also discussed.

From Gregory W. Fischer, Nirmala Damodaran, and Kathryn B. Laskey, Dept. of Social Sciences, Carnegie-Mellon University, Pittsburgh, PA 15213; and David Lincoln, CH2M Hill, Bellevue, Washington. (Address Correspondence to Professor Fischer.)

Preferences for Proxy Attributes: The Overweighting Bias.

A proxy attribute is an indirect measure of an ultimate decision objective. Keeney and Raiffa (1976) have argued that the use of proxy attributes violates the "divide and conquer" principle and thus may bias the results of a decision analysis. To test this hypothesis we conducted an experimental study of preferences for pollution control alternatives. Each decision maker made two sets of utility assessments: the first regarding outcomes described by the fundamental attributes "pollution control cost" and "pollution related morbidity"; the second regrding outcomes described by the fundamental attribute "pollution control cost" and the proxy attribute "pollutions emissions level" (which served as an indirect measure of "morbidity"). The results of the study indicated that when decision makers directly assessed scaling constants regarding tradeoffs between the fundamental attribute cost and the proxy attribute emissions level, they in effect gave

too much weight to the proxy attribute relative to the prescriptions of expected utility theory. The tendency to overweight proxy attributes was so large that it led to seriously suboptimal policy decisions in our simulated decision setting. To explain this tendency to overweight proxy attributes, we developed a "worst case" heuristic preference model that predicts this bias. This worst case model provided a significantly better fit than the expected utility model to individual preferences for outcomes described by cost and the proxy attribute emission level.

From L. Robin Keller, Graduate School of Management, University of CA-Irvine, Irvine, CA 92717; Rakesh K. Sarin, Graduate School of Management, University of CA-Los Angeles, Los Angeles, CA 90024; and Martin Walker, Lehr-und Forschungsgebiet Allgemeine Betriebswirtschaftslehre, Rheinisch Westfalische Technische Hochschule, D-1500 Aachen, Federal Republic of Germany. (Address correspondence to Professor Keller.)

Empirical Investigation of Some Properties of the Perceived Riskiness of Gambles

Empirical tests of some properties of the perceived riskiness of gambles are reported. In experiments conducted with U.S. and German subjects we observed a remarkable consistency in risk judgments. Four possible measures of risk, derived by R. Duncan Luce, were examined. We found that risk decreases as a constant amount is added to all outcomes of a gamble. Two of Luce's measures require that risk not change with the addition of a constant, and thus these measures are not appropriate for describing perceived risk. We also found that Luce's logarithmic measure is not empirically valid. Luce's fourth measure (the expectation of the absolute value of the outcomes raised to a parameter θ) seems to have more promise than his other three measures. These results provide some necessary conditions that a new theory or extension of Luce's measures must satisfy.

From Farrokh Alemi and John Agliato, School of Public Health and Tropical Medicine, Tulane University, 1501 Canal Street, New Orleans, LA

Illustrative Analysis of One Employer's Decision to Join a Preferred-Provider Arrangement

Employers often need to make a decision about whether to enter into a contractual agreement with a health care provider and, if so, under what terms. This is a complex decision with uncertain consequences and large stakes. It needs to be defended in front of organizational boards. Its cost and benefits need to be commun- icated effectively to skeptical employees. By reducing the complexity of the decision, analysis may help in the negotiations between the provider and the employer. This paper describes an example.

In a recent application, an employer was concerned that the combined effect of (1) new administrative costs, (2) different hospitalization costs, (3) changes in utilization patterns, and (4) different clinical costs would undermine any savings obtained through discounts offered. Analysis was able to show that a discount will lead to large changes in number of clinical visits as well as small changes in the frequency of hospitalization. Despite the changes in utilization patterns, however, it was still beneficial to join the preferred provider arrangement. The discounted hospitalization cost after adjustment for case mix differences was low enough to produce savings.

Even with more than thirty percent increase in number of clinical visits some savings persisted.

From B.A. Brotman, College of Charleston, Charleston, SC 29424

Capital Budgeting: Current Practices and Changes over a Decade

A survey was conducted in 1983 to compare current capital-budgeting practices with those observed by Fremgan in 1973. Comparative percentages of firms actually using (1983%/1973%): Internal rate of return (72/71), payback (66/67), net present value (46/20), accounting rate of return (28/49), profitability index (11/6), and other (5/10). Comparative percentages of firms regarding this method as most important (1983%/1973%): IRR (47/38), NPV (22/4), payback (22/14), ARR (5/22), PI (3/1), other (1/5). Firms indicated that uncertainty about future cash flows was explicitly considered, but now purely subjective consideration (53%/29%) leads requiring higher than normal profitability (30%/54%), better than normal payback period (25%/40%), and other forms of adjustment.

Recently Published-Submitted for Listing

"The Wasted Vote Fallacy", by Robert D. Behn and James W. Vaupel. Journal of Policy Analysis and Management 3, No. 4

"An Application of the Likelihood/Bayes Approach to the Estimation of Safety Countermeasure Effectiveness" and "Reflections on Methods of Statistical Inference in Research on the Effect of Safety Countermeasures", by Ezra Hauer, in Accid. Anal. & Prev. 15, No. 4.

"A Roadmap for Complex Decisions", by Ralph L. Keeney, in EPRI Journal, September 1983.

See also the attached listing from Robert F. Bordley.

--- FROM ROBERT F. BORDLEY ---

Dear Fellow LIST member,

I'll be happy to send you reprints(or preprints) of any of the following articles. (They are organized by topic headings.)

I-Combining Forecasts and Demand Modelling

(a) "Relating Elasticities to Changes in Demand." Bordley, Journal of Business and Economic Statistics." (1984,in press). Elasticity estimates which describe the effects of marginal price changes are often extrapolated to estimate the effects of large price changes. This paper provides some conditions under which various kinds of extrapolations are valid. It shows that for certain kinds of models commonly used in approximating demand equations, there is a fairly simple formula relating relative changes in demand given finite price changes to the ratio of cross-elasticities. This result has a number of important applications in pricing questions.

(b) "Bayesian Group Decision Theory," Bordley, in Grofman,B. and Owen,G. Information Pooling and Group Decision-Making. Dordrecht Publishers, Amsterdam (in press).
This chapter reviews the literature on aggregating probability assessments and utilities. We pay special attention to the criticisms raised by Zeckhauser, Dalkey, Diamond and Broome. We discuss proposed formulas from Morris,Madansky,Bordley, French,Harsanyi, and Keeney. Our thesis is that the many paradoxes encountered in this field indicate the need to educate our intuition in line with the demands of consistency.
We show that Madansky's formula leads to a violation of a fairly intuitive notion of monotonicity or unanimity. This violation occurs because the weights assigned experts in Madanksy's formula depend on expert probability assessments. By suitably varying these probability assessments, we can make the weights change so as to violate monotonicity. We interpret this result as indicating the inadequacy of Monotonicity as a condition on probability aggregation.

(c) "A Multiplicative Formula for Aggregating Probability Estimates." Bordley. Management Science (October,1982).
This paper considers the problem of aggregating n individual probability estimates into a group probability. We impose a number of axioms on a decision maker's preference ordering of expert assessments. The result is a formula which involves raising each expert assessment to some weight, multiplying all the weighted expert assessments together and finally multiplying by some calibration factor. This formula is consistent with other results.

(d)The Combination of Forecasts:A Bayesian Approach.Bordley

Journal of the Operational Research Society.(February,1982). This paper formulates the problem of combining n point-estimates of some quantity in a Bayesian fashion. Depending upon the assumptions we make about the distribution of expert forecast errors, we get weighted average, geometric average or other formulas for aggregating those estimates into a combined forecast.

(e) "The Aggregation of Individual Probability Estimates." Bordley and Wolff. Management Science (August,1981)
This paper argues that many paradoxes associated with aggregating individual probability estimates arise from an implicit context-independence assumption. We note that most existing formulas for aggregating probability assessments are,in fact, context-dependent.

II-Political Science

(a) "A Precise Method for Evaluating Election Schemes." Bordley. Public Choice. 1984.
This paper basically repeats the simulation done in (c) below with:
(a) the Johnson-Payne performance measure: (This measures desirability as performance relative to that of the ideal election system).
(b) Using 50,000 trial repetitions instead of 1000 and computing Tukey significance intervals. This allows us to discriminate among all the election systems. We can thus make very detailed descriptions of when certain election schemes are appropriate.
(c) We note that we can use our results to assess the gain in utility to society from introducing one voting scheme over another. If we integrate this information with the costs of introducing a new voting scheme, we can do a cost-benefit analysis of election proposals.

(b) "Factions as a Measure of Preference Intensity: An Argument Against One Person/One Vote." Public Choice
This paper takes Harsanyi's average utility criterion and shows that correlation among voter utilities implies that a weighted voting system is better than one person/ one vote. We construct an example and compute the appropriate voting weights.

(c) "A Pragmatic Approach to Evaluating Election Schemes through Simulation." Bordley. American Political Science Review. (March,1983).
This paper is concerned with measuring the 'goodness' of

various election schemes (One Person/One Vote,Approval Voting, Borda Voting,etc.) in a wide variety of simulated circumstances. The circumstances are specified by generating 1000 matrices. Each matrix specifies the utility of each voter for each election alternative. The matrices are generated by specifying the correlation among individual utilities and the probability distribution of utilities. We then judge the goodness of the result chosen by an election via Harsanyi's average utility. We vary correlation,utility distribution,number of voters and number of election alternatives to see how different voting systems compare under different circumstances.

(d) "A Model of Risky Shift". Bordley. Organizational Behavior and Human Performance.(October,1983).
Using the multiplicative formula for aggregating probability estimates, this paper develops a model of the risky shift phenomena.

(e) "Deducing Warr's Power Function." Bordley.Social Forces. (September,1982).
This paper imposes certain rationality and realism axioms on an individual assessment of probability which allows us to deduce a relationship between that individual's probability assessment and an actuarially-based probability assessment. We use these results to deduce the empirical formulas found in a study on public perceptions of crime by Mark Warr.

III-Using Decision Theory as a Foundation for Other Sciences.

(a)A Standard (Non-Quantum) Probability Model of Quantum Behavior Bordley. Journal of Mathematical Physics.(September,1983).
This paper develops a model of a particle as choosing that path which minimizes the time-integral of its Lagrangian. However the experimenter cannot measure the Lagrangian precisely so that the Lagrangian is random. We then apply the results of random utility theory to get a formula for the probability of the particle following a given path. We assume that the random component of the Lagrangian varies sinusoidally over time and show that this produces the quantum effects of quantum theory.
This result shows that it is not necessary to generalize probability theory to a 'quantum probability' theory in order to model quantum effects.

(b) "Deriving the Schroedinger Equation and Hamilton's Principle from General Consistency Conditions." International Journal of Theoretical Physics. Bordley.(September,1983).
This paper pursues the program outlined in the previous article in Behavioral Science. We focus on Physics. We show that we can get Hamilton's Principle and the Schroedinger Equation by thinking of the particle as choosing that path which maximizes its expected utility. The particle's utility

function is chosen to be the negative time-integral of its Lagrangian and its subjective probability distribution is constrained to satisfy Heisenberg's Uncertainty Principle.

(c) "A Central Principle of Science: Optimization. " Bordley. Behavioral Science (January,1983).
This paper considers the implicit assumptions of consistency underlying any scientific theory of nature. We formalize those assumptions using the Savage axioms and conclude that any scientific theory must, in principle, be susceptible to being formalized in terms of maximizing some utility function.

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