

DECISION ANALYSIS NEWSLETTER

Published by the ORSA Special Interest Group on Decision Analysis

VOLUME 8, NUMBER 2

September, 1989

Editor's Note

Just a reminder that we are eager to publish abstracts of all papers in the area of Decision Analysis, broadly conceived. 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 your *complete paper* to the editor:

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.

Please Note: Inform the ORSA business office of address change; we get our mailing labels from them! Thanks!

Inside

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Santa Cruz Conference

A stimulating conference on Utility Theories, Measurements, and Applications, organized by Ward Edwards and funded by the NSF DRMS Program, was held at Santa Cruz, CA, from June 11th to June 15th this year. The next issue of the Newsletter will include abstracts of the papers presented.
(cont. page 2)

News from NSF's Decision, Risk, and Management Science Program by James Shanteau and L. Robin Keller

The National Science Foundation's Decision, Risk, and Management Science (DRMS) Program has completed another successful year under the direction of Program Director Howard Kunreuther and Associate Program Director Robin Gregory, who completed their terms of service this summer. Dr. Kunreuther has returned full-time to his Wharton responsibilities and Dr. Gregory has returned to Decision Research. We wish to thank them for their outstanding
(cont. page 2)

From the Chairperson - Samuel E. Bodily
(804) 924-4813; Box 6550, Charlottesville, VA 22906

I thank Robin Keller for organizing the Decision Analysis session at the Vancouver meeting. Robin and Bob Clemen completed their terms on the SIG Council at that meeting; we appreciate their many contributions. The new council members are Allan Murphy and Ross Shachter.
(cont. page 3)

NSF News (cont.)

service to the decision, risk, and management science community.

We would also like to introduce ourselves at this time. James Shanteau is the new Program Director and L. Robin Keller will be the new Associate Program Director. Jim is on leave from Kansas State where he is a professor in the Department of Psychology and Robin is on leave from the Graduate School of Management at the University of California, Irvine, where she is an associate professor of decision sciences.

We have both arrived in Washington, DC, and look forward to keeping in touch with the members of the decision, risk, and management science community. We plan to attend the conferences of the constituent groups that represent the DRMS field. We can also be reached by telephone, mail, electronic mail, and facsimile: Dr. James Shanteau, Program Director; Telephone: (202) 357-7417; Bitnet: jshantea@nsf; Internet: jshantea@note.nsf.gov

or

Dr. L. Robin Keller, Associate Program Director; Telephone: (202) 357-7569; Bitnet: lkeller@nsf; Internet: lkeller@note.nsf.gov Facsimile: (202)357-7745 (include name, DRMS, and room 336)

Mailing address: Decision, Risk, and Management Science Program, Room 336, National Science Foundation, 1800 G Street N.W., Washington, D.C. 20550

Program Overview

Research proposals are solicited on fundamental issues in management science, risk analysis, public policy decision making, judgmental processes, behavioral decision making, organization design, and decision making under uncertainty. Target dates for proposals are January 15 and August 15 each year. A Decision Risk, and Management Science Program statement flyer is available from the Program Directors.

The review and evaluation process for proposals requires about six months. It includes *ad hoc* evaluations by outside reviewers and the recommendation of the advisory panel. Members of the DRMS Advisory Panel for 1989-90 are Dr. Janice M. Beyer, Dr. Warren H. Hausman, Dr. Ralph L. Keeney, Dr. Kenneth R. MacCrimmon, Dr. M. Granger Morgan, Dr. (cont. page 4)

Charles Harvey - after many years at Dickinson College, has moved to warmer climes: Decision and Information Sciences Dept., College of Business Administration, University of Houston, Houston, Texas 77204-6282.

Santa Cruz (cont.)

Alphabetically, the speakers were Colin Camerer (Wharton School, Univ. of PA), Soo Hong Chew (A. B. Freeman School of Business, Tulane Univ.), Ronald A. Howard (EES Dept., Stanford Univ.), Ralph L. Keeney (Institute of Safety and Systems Mgt, USC), L. Robin Keller (Graduate School of Mgt., UC-Irvine), Irving H. LaValle (A. B. Freeman School of Business, Tulane Univ.), R. Duncan Luce (Irvine Research Unit of Mathematical Behavioral Science, UC-Irvine), John Miyamoto (Psychology Dept, Univ. of Washington), Rakesh K. Sarin (Fuqua School of Business, Duke Univ.), Uzi Segal (Economics Dept., UCLA), and Amos Tversky (Psychology Dept., Stanford Univ.). Discussion was guided, facilitated, and often crystallized by an outstanding panel of discussants: Thomas Eppel (Social Science Research Institute, USC), Stuart Eriksen (Graduate School of Mgt., UC-Irvine), David Matheson (EES Dept., Stanford Univ.), John Miyamoto, and George Wu (Decision Sciences Program, Harvard Univ.).

Papers and discussion will appear in a book that Ward will edit. A felicitous by-product of the conference was a set of topically relevant musical adaptations, available upon request from Irv LaValle.

Chairperson (cont.)

Don Keefer is organizing sessions for the Las Vegas meeting, May 7-9, 1989; Howard Kunreuther and Colin Camerer are organizing sessions for Philadelphia, October 28-31, 1990. I hope to see you at the New York meeting, including our SIG meeting at 5:15 on Monday; Don Kleinmuntz has organized a full slate of engaging sessions for us.

In our SIG Council meeting in New York, we will consider nominees for the Ramsey award--which recognized significant, long-term contributions to decision analysis.

(cont. page 3)

Chairperson (cont.)

Please contact me or a council member with any nominations. Be prepared to provide supporting rationale for your nomination.

We will also finalize plans for the Best Paper award at this SIG Council Meeting. We are talking about making the first award in Fall 1990, based on publications that appeared in the calendar year 1988. Any article, chapter, book, monograph, etc. published during that period would be eligible--authors could not nominate their own work. The proposal is to run the competition like the Student Paper Competition, with a chairperson who publicizes the competition, receives nominations, organizes a panel of judges, and oversee selection of the winner. Your comments on the award and associated procedure to council members would be welcome.

"Expression Tree" Software

Craig Kirkwood has a new decision tree analysis program available for IBM compatible personal computers. The program, EXPRESSION TREE, is primarily intended for use in decision analysis instruction. It runs on IBM-compatible personal computers with any type of display and at least 256K memory.

The program allows rapid construction and analysis of trees through use of decision variables and random variables as well as algebraic expressions. Specifically, it includes capabilities for (1) use of algebraic expressions to calculate the values of end points, (2) use of algebraic expressions to calculate branch probabilities, (3) automated sensitivity analysis, and (4) full-screen field-oriented editing for data input. Exponential and linear single-attribute utility functions are supported.

A single user license is \$25.00 and includes one copy of the software and one bound copy of the manual. An instructional license is \$50.00 and includes one copy of the software, one bound copy of the manual, and one unbound copy of the manual for use in copying. An instructional license grants permission for the license holder to make copies of the program and documentation
(cont.)

Expression Tree (cont.)

for direct instructional use provided that no fee is charged for these copies (other than a nominal amount to cover copying expenses) and that no financial gain accrues to the license holder, either directly or indirectly. Thus, this license generally grants the right to make copies for use in regular academic instruction.

Make checks payable to "DIS Department Gifts and Grants Account." (Sorry, no credit cards or purchase orders.) Indicate if you need a 3.5" diskette. Order from: Craig W. Kirkwood, Department of Decision and Information Systems, College of Business, Arizona State University, Tempe, AZ 85287-4206.

Robust Interactive Decision Analysis (RID)

The *Robust Interactive Decision maker* (RID) is an interactive graphics oriented integrated software system for both professional and inexperienced end users. RID is designed to provide an alternative to traditional decision analysis. Traditional decision analysis requires obtaining explicit, precise, and complete information about a decision maker's (DM's) beliefs and tastes, manifested by a subjective probability and utility function. Subjective probability and utility information are often difficult and costly to obtain from a decision maker, and can be unreliable and biased. Moreover, an optimal strategy in a decision analysis problem is generally robust to the precision of the subjective probability and utility information, hence, imprecise information of this nature may only be necessary to achieve optimality.

In RID, the only information elicited is that which the DM wishes to provide, to whatever degree he or she is willing and able to do so. For example, a probability judgment can be expressed on either an ordinal, or cardinal scale, or not at all. Nonlinear utility function parameters are inputted from a certainty equivalent for a gamble and/or expressed strong preferences, and can be either point or interval estimates. Only strong binary preferences (viz, "surely preferred to") are expressed for alternatives or partial/full
(cont.)

RID, (cont.)

decision functions to minimize inconsistencies. These judgments and preferences are incorporated into an interactive procedure which repeatedly prunes the probability and decision space until a single "optimal" or a small subset of efficient decision functions remains. Cluster analysis is an additional option available to accomplish further pruning.

A self-destructing demo disk, and pricing information concerning its more permanent siblings, are available from Professor Herbert Moskowitz, Krannert Graduate School of Management, Purdue University, West Lafayette, IN 47907.

Policy PC: Judgment Analysis Software

Judgment analysis, also called policy capturing, refers to the use of statistical methods for developing descriptive models of human judgment. POLICY PC helps you analyze how experts, or other individuals, intuitively make judgments as they integrate available information. POLICY PC:

- * Analyses the judgment of up to 8 individuals based on as many as 8 information cues (text or numeric) and 100 cases;
- * Computes statistics for
 - each task (cue means, standard deviation, and inter-correlations),
 - each judge (judgment mean, standard deviation and correlations between judgments and cues),
 - each policy (regression coefficients, multiple R, and predicted judgments);
- * Statistically compares up to 8 policies at a time;
- * Graphically displays the relative weights and functional relationships of cues for each judge and compares up to 3 judges on one graph;
- * Allows policy specification via a menu of utility functions;
- * Automatically generates cases and varies the order of cues from one case to the next if desired;
- * Displays the cases on screen for interactive use or writes the cases to a file for word processing to produce a printed questionnaire. *(cont.)*

Policy PC (cont.)

POLICY PC operates on the IBM PC and compatible computers and requires 512K RAM (a version that operations with 256K RAM is available).

Individual user licenses are \$75; corporate/institutional license is \$500; and a student edition is available at \$10 per copy with minimum order of 8 copies.

Executive Decision Services, Inc., P.O. Box 9102, Albany, NY 12209-0102

NSF News (cont.)

Donald G. Morrison, Dr. John W. Payne, and Dr. Stephen M. Pollock. We thank Dr. George Huber, Dr. Arie Lewin, Dr. Sarah Lichtenstein, and Dr. John D. C. Little, who have just complete their terms of service on the panel.

Preview of the New Joint NSF/Private Sector Research Opportunities Initiative

We are continuing the development of the new Joint NSF/Private Sector Research Opportunities Initiative of the Decision, Risk, and Management Science Program which was launched by Howard Kunreuther and Robin Gregory. By the time this is published, we should have received final approval on this initiative. Our plan is to fund up to five projects in 1990, the first target date is January 15, 1990. The awards would provide the principal investigator up to \$75,000 per year to match private sector financial support for qualifying DRMS research projects. The initiative is designed to encourage theory building through applied studies in private sector settings. Proposals submitted under this initiative differ from proposals normally submitted to DRMS in that they are required to have a key contact person within the cooperating private sector organization who is actively involved in the development of the proposal and in the conduct of the research process. The organization must also indicate an interest in providing funds to support the project should the proposal be approved by the National Science Foundation. Please contact the DRMS Program Directors for a copy of the Initiative announcement.

Highlights of Other NSF Programs of Possible Interest

There are many programs across the National Science Foundation which fund

Chairperson (cont.)

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Expression Tree (cont.)

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activities of interest to some members of the DRMS community. Two examples are the programs for funding doctoral dissertation and teaching programs.

Grants for Improving Doctoral Dissertation Research provide funds for items not normally available from the student's university or other sources. Allowable items include travel to specialized facilities, sample survey costs, specialized research equipment and services not otherwise available, supplies, payments to subjects, and rental for research facilities. There are limitations on the uses of funds. For example, the funds may not be used for a stipend for the student, for tuition, or for travel to scientific meetings. Contact the DRMS Program Directors for more (cont.)

information concerning support for dissertation work in fields covered by the DRMS program.

The *Research Training Groups (RTG)* Program provides funding to create new or enhanced multidisciplinary educational and research opportunities at an institution. Ph.D. granting U.S. academic institutions are invited to submit abbreviated proposals by Nov. 3, 1989, for the first round of the review process. Awards will be made for 5 years, and are expected to average \$250,000 annually, plus a one-time allocation of up to \$250,000 may be requested for special purpose research materials and equipment. Contact the DRMS program directors for more information concerning support for multidisciplinary research training programs in decision, risk, or management science.

PAPERS RECEIVED

Please request copies directly from the author, not the Newsletter Editor

From **Robert F. Bordley**, General Motors Research Laboratories, 30500 Mound Rd., Warren, MI 48090, and **Gordon B. Hazen**, Dept. of IE & MS, Technological Institute, Northwestern University, Evanston, IL 60201:

SSB and Weighted Linear Utility as Expected Utility with Suspicion

We show that a "suspicious" subjective expected utility (SEU) maximizer, i.e., one who treats potential consequences of states as information useful in assessing the probability of those states, may under reasonable circumstances act as if he is maximizing either weighted linear utility, or skew-symmetric bilinear (SSB) utility. SEU with suspicion therefore explains at least as many empirical violations of SEU theory as do these and similar models. We give examples to illustrate how several important types of SEU violations may seem to arise when suspicion is present.

From **Jeff T. Casey**, W. Averell Harriman School for Mgt. and Policy, SUNY-Stony Brook, Stony Brook, NY 11794

Reversal of the Preference Reversal Phenomenon

The widely replicated preference reversal phenomenon (PRP) violates most theories of decision under risk. People exhibiting PRP choose a safe bet (with a large chance of a small gain) over a long-shot (with a small chance of a larger gain). But, when bidding to buy or sell each bet, they bid more for the long-shot. Surprisingly, in Experiment 1 a new, opposite reversal pattern (NPRP) was found: Safe bets typically received larger bids than long-shots and reversals were far more frequent when the *long-shot* was chosen. In

Experiment 2, NPRP was found for \$100 expected value bets, but PRP occurred for bets with \$3 expected values. The task characteristics apparently necessary to produce NPRP are: (1) bids in the form of maximum buying prices, (2) possibility of loss in bidding, but not in choice, and (3) large payoffs. It is hypothesized that a contingent decision process underlies the shift in reversal patterns and that aspiration levels exert increased influence in bidding to buy when payoffs are large.

From **Frank Costagliola**, 307 Gibbon St., Alexandria, VA 22314:

An Environmental Model

The paper examines the relationship between Humanity and the Environment utilizing the physical law of conservation of mass and energy. If we look at the Environment as a monolithic thing, we find that the concept, "We must protect our Environment in order to survive" is wrong. If we break the Environment down into the components that are of particular concern to Humanity we find that human survival depends on putting our energy and material resources to work to meet Human needs and to solve the problems that are continually being generated by our existence.

From **Peter C. Fishburn**, Rm 2C-354, AT&T Bell Laboratories, 600 Mountain Ave., Murray Hill, NJ 07974

The Ackoff Factor

During the past 30 years I have had the good fortune to continue research in the foundations of decision theory and other areas that began when I was a graduate student of Russ Ackoff at Case Institute of Technology. As time has gone by, I have become increasingly aware of the enormous influence that the seeds implanted by him have had on so much of my subsequent work. This paper focusses on recent work in nontransitive preferences and additive conjoint measurement, and traces my concern with these topics back to events that Russ had a hand in a generation ago. It is always a pleasure to thank people who have done nice things for you. When the nice things encompass a career, the pleasure is truly extraordinary.

Nontransitive Additive Conjoint Measurement

Nontransitive additive conjoint measurement generalizes the familiar model for additive conjoint measurement by not assuming that the comparative relation between n -tuples in a product set is transitive. However, the nontransitive model retains the independence conditions of additive conjoint measurement that lead to a real-valued representation for the comparative relation that is additive over the n factors.

Three sets of axioms for the comparative structure that imply representability by a nontransitive additive conjoint model are presented. The first gives necessary and sufficient conditions for representability when all n factors are finite sets. The second identities necessary and sufficient conditions when $n=2$ and the factor sets are arbitrary. The third gives algebraically oriented sufficient conditions when $n \geq 3$ which imply that the representing functionals are unique up to multiplication by a positive constant. The third axiomatization offers an alternative to earlier topologically oriented sufficient conditions that imply continuity as well as uniqueness for the representing functionals.

Skew Symmetric Additive Utility with Finite States

The skew symmetric additive utility model for decision under uncertainty generalizes Savage's model by replacing his utility function on outcomes by a skew symmetric functional on ordered pairs of outcomes. This paper presents a preference axiomatization of the generalized model for finite state spaces that is based on a recent axiomatization for nontransitive additive conjoint measurement in multiattribute utility theory. The approach taken here is compared to previous approaches based on lottery acts and on the structure of Savage's infinite-states formulation.

From **Peter C. Fishburn** (address above) and **Yutaka Nakamura**, University Tsukuba (address requests to Dr. Fishburn):

Nontransitive Measurable Utility with Constant Treshold

Let $>$ denote a preference relation on a convex P of probability measures. This paper identifies conditions for $>$ on P that are necessary and sufficient for the constant threshold representation

$$p > q \Leftrightarrow \phi(p, q) > 1,$$

where ϕ is a skew symmetric bilinear functional on $P \times P$. Simpler subsets of those conditions suffice when $>$ is unbounded or when there is either no most preferred measure in P . Provided that $>$ is not empty, the functional ϕ in the representation is unique.

From **Charles M. Harvey**, College of Business Administration, University of Houston, Houston, TX 77204:

Models of Tradeoffs in a Hierarchical Structure of Objectives

Multiattribute utility models and cost-benefit models often arrange the objectives into a hierarchical structure in order to identify appropriate objectives and to select appropriate variables to measure the objectives. This paper discusses models that use the hierarchical structure in order to examine issues of tradeoffs and of equity that are judged to be important. These models can represent a variety of issues that models in present use are not able to include. The models are sufficiently structured so that they can be applied by procedures similar to those that are available for other prescriptive models of preferences.

From **Gordon B. Hazen** and **Jia-Shen Lee**, Dept. of IE and MS, Technological Institute, Northwestern University, Evanston, IL 60201

Ambiguity Aversion in the Small and in the Large for Weighted Linear Utility

The widely observed preference for lotteries involving precise rather than vague or ambiguous probabilities is called ambiguity aversion. Ambiguity aversion cannot be predicted or explained by conventional expected utility models. For the subjectively weighted linear utility (SWLU) model, we define both probability and payoff premiums for ambiguity, and introduce a *local ambiguity aversion function* $a(u)$ which is proportional to these ambiguity premiums for small uncertainties. We show that one individual's ambiguity premiums are *globally* larger than another's if and only if his $a(u)$ function is everywhere larger. Ambiguity aversion has been observed to increase (i) when the mean probability of gain increases and (ii) when the mean probability of loss decreases. We show that such behavior is equivalent

to $a(u)$ increasing in both the gain and loss domains. Increasing ambiguity aversion also explains the observed excess of sellers' over buyers' prices for insurance against an ambiguous probability of loss.

From **Stuart S. Nagel**, Dept. of Political Science, 361 Lincoln Hall, University of Illinois, 702 South Wright St., Urbana, IL 61801

Weighting Goals in Policy/Program Evaluation

Weighting goals recognizes that not all goals are of equal importance and that indicating their relative importance may influence which alternative, combination of alternatives, or allocation of scarce resources is best. The paper is concerned with the problems involved in (1) assigning weights or measures of relative importance to goals, (2) resolving inconsistencies in the assignment of weights, (3) considering diminishing returns in weighting goals, (4) comparing weights with and without multi-dimensionality among the goals, (5) comparing weights in choosing and allocation problems, (6) relating weights to the spread on the measurement units, (7) averaging weights, and (8) providing an illustrative example by way of the problem of weighting the criteria in determining the comparable worth of different government jobs.

Handling Multiple Dimensions in Evaluation Analysis

A difficult problem which often occurs in evaluation analysis is how to give overall scores to activities, places, or other entities which are being compared or evaluated, even though each aspect of the comparison or the evaluation is measured on a different scale. This is more difficult than adding apples and oranges because public program evaluation often deals with abstract measures like fair procedure and negative goals like crime. Alternative ways of dealing with the problem include paired increments, percentaging, weighted raw scores, monetizing, 1-5 scales, interpolation, logarithms, and multiplying raw scores. The paper concludes that different approaches are needed for different situations. The approach of part/whole percentaging is especially relevant where the goals are abstract measures, although weighted raw scores may be meaningful with more concrete measures.

Multi-Criteria Dispute Resolution Through Computer-Aided Mediation

The essence of the methodology is the idea of working with multiple alternatives and multiple-criteria in an easily manipulated spreadsheet format to arrive at super-optimum solutions that exceed the original best expectations of the disputants. The process involves determining for each side the goals they would like to achieve, the alternatives available for achieving those goals, and their perceptions of the relations between the goals and the alternatives in order to arrive at an alternative that is mutually beneficial to both sides. It is even possible to arrive at super-optimum solutions that are better than the initial best expectations of all sides, given the range of goals and alternatives that are available and the sensitivity analysis that is associated with spreadsheet analysis. Achieving super-optimum solutions may not require the assistance of computers and decision-aiding software, but that kind of assistance can facilitate such solutions. It can thereby enable decision-makers and mediators who are not so expert to increase the power of their skills, and those who are experts can do even better.

From **Robert F. Nau**, Fuqua School of Business, Duke University, Durham, NC 27706:

Joint Coherence in Games of Incomplete Information

This paper presents a characterization of mutually expected rationality in games of

incomplete information that does not rely on the Nash equilibrium concept or the common prior assumption (CPA) as primitives. Instead, rationality is defined in terms of the avoidance of arbitrage opportunities arising from preferences implied by the players' observable behavior. The concepts of "correlated" Bayesian equilibrium and communication equilibrium, as well as a weak form of the CPA, are obtained as theorems.

From **Gerald F. Smith, P. George Benson, and Shawn P. Curley**, Information and Decision Sciences Dept., Curtis L. Carlson School of Management, 271 19th Avenue South, University of Minnesota, Minneapolis, MN 55455 (address requests to Dr. Smith):

Belief, Knowledge, and Uncertainty: A Cognitive Perspective on Subjective Probability

This paper presents a cognitive analysis of subjective probability judgments and proposes that these are assessments of belief processing activities. The analysis is motivated by an investigation of the concepts of belief, knowledge, and uncertainty. Judgment and reasoning are differentiated, Toulmin's (1958) theory of argument being used to explicate the latter. The paper discusses a belief processing model in which reasoning is used to translate data into conclusions, while judgmental processes qualify those conclusions with degrees of belief. The model sheds light on traditional interpretations of probability and suggests that different characteristics of belief--likelihood and support--are addressed by different representational systems. In concluding, the paper identifies new lines of research implied by its analysis.

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

Characteristics of Risk-Taking Executives

More than 500 top-level business executives were studied to ascertain the validity of common stereotypes of who takes risks and who avoids risks. We began with 13 risk measures based on theoretical grounds, naturally occurring situations, and attitudes. These measures were formed into seven consolidated measures using factor analysis. Data were gathered on numerous socio-economic variables including ones related to personal, financial, and professional characteristics. When these characteristics were subjected to factor analysis, four main factors emerged. Linear discriminant analysis was used to address the question of whether risk takers can be differentiated from risk averters. The results were surprisingly clearcut. The most successful executives were the biggest risk takers; the most mature executives were the most risk averse.

From **Ilan B. Vertinsky and Donald A. Wehrung**, (at above address):

Risk Perception and Drug Safety Evaluation

The intuitive risk judgments that people make when they evaluate hazards (i.e., public risk perception) often differ from the judgments made by regulators responsible for ensuring public safety based on scientific evidence. Public risk perceptions may involve legitimate reflections of risk preferences as well as unfounded fears. The expressions of unfounded fears and public response to them sometimes influence the regulatory process in counter-productive ways, and they may distort socially efficient market processes. In this paper we develop a model of the relationships between public risk perceptions and the regulatory process to promote public safety based on the extant literature concerning risk perceptions, and we survey the existing empirical evidence about the postulated relationships. The resulting framework is then applied to the role of public risk perceptions in drug safety

evaluation to derive some general recommendations regarding communication strategies aimed at the attainment of higher safety levels.

From **Milton Taylor**, International Behavioral Medical Center, 300 West Basin Rd., New Castle, DE 19720, and **Naomi Kamei**, Princeton University, Princeton, NJ:

Practical Intelligence Training, Audio-Feedback and Managerial Success in Judgment/Decision Making: An Evaluation Study

This study evaluated the value of practical intelligence training as an educational technique. Training and presentation of audiofeedback were manipulated. A nonequivalent comparison group of executives (N=19) represented a condition of no training or feedback. Business students were randomly assigned to a treatment group (N=8) or delayed treatment group (N=5), representative of when feedback was presented to supplement training. Dependent variables were: number of problems solved, number of problems attempted, and thinking style rigidity. Delayed treatment subjects were more rigid than comparison subjects, $p = .05$. Furthermore early treatment subjects were less rigid than delayed treatment subjects, $p < .03$. Subjects' thinking style was not correlated with problem solving behaviors. Suggestions were made for improving practical intelligence research. An implication of the results was that providing delayed feedback makes subjects more rigid in their thinking style.

From **Robert L. Winkler** and **Robert T. Clemen**, Fuqua School of Business, Duke University, Durham, NC 27706:

Sensitivity of Weights in Combining Forecasts

In the combination of forecasts, it seems desirable to take into account the accuracy of the forecasts and any dependence among forecasts. Yet the normal model typically used to reflect these characteristics consistently performs poorly in practice. An important factor influencing this performance is the sensitivity, or instability, of the estimated weights used to generate the combined forecast. The intent of this paper is to provide some new insights concerning this instability, focusing on graphs and the sampling variability of the weights. Results are developed for the combination of two forecasts and extended to the k-forecast case by viewing the k-forecast case as a sequence of two-forecast combinations. Other factors contributing to the sensitivity of the weights and some more robust combining methods are discussed briefly.

An Extended Abstract:

Taking Risks: The Management of Uncertainty

by **Kenneth R. MacCrimmon** and **Donald A. Wehrung**, New York: The Free Press [a division of Macmillan, Inc.], 1986. (available in paperback)

Taking Risks is the first book to examine systematically how extensive numbers of senior executives deal with a wide variety of risky situations as viewed from a number of prescriptive and descriptive theories. The study on which the book is based is unique in its use of (a) a portfolio of realistic situations to measure willingness to take risks, including hypothetical choice situations, naturally-occurring risks, and attitudes, and (b) large numbers of senior executives as subjects. Prior empirical studies of risk were usually conducted using students as subjects and only one or two different situations to measure risk propensity. As

more and more studies of risk confirmed the context dependent nature of risk propensity, it became more imperative to use multiple risky situations to investigate risk attitude.

Part One of the book presents a conceptual foundation for understanding risk and risk taking. This part discusses the three components of risk (i.e., magnitude of loss, chance of loss, and exposure to loss), the three determinants of risk (i.e., lack of time, lack of information, and/or lack of control), and the REACT model of managing risk that separates the stages of risk into Recognition (or perception), Evaluation, Adjustment (or modification), Choice, and Tracking. An important contribution of this part of the book and the empirical research that follows is the broadening of the study of risk to include stages other than risky choice, especially the adjustment stage in which executives try to influence the risky situation to obtain a better set of alternatives to choose from. Part One also describes the portfolio of risk instruments used to examine the executives' risk tolerances.

Part Two presents four studies of executive risk taking in different standardized (and hypothetical) risky situations. Although these four studies are also discussed in four auxiliary journal articles or book chapters, the findings presented in Part Two are extended and merged into a coherent whole in Chapter 7 that gives a managerial summary and discussed implications for both managers and academics. Chapter 3 introduces the use of an in-basket exercise to study risk. An important contribution of this format is its use of open-ended written memos to capture how executives handle risky situations without limiting them to predetermined strategies having closed-ended response modes such as rating scales. This study highlights the need to better understand the role that risk adjustment plays in actual risky situations.

Chapter 4 constructs risk preference curves for both personal wealth and business wealth. A number of discrepancies with standard postulates of expected utility theory are observed and discussed. Distinct differences are seen for one's business wealth than for his personal wealth. A secondary dimension underlying the risk preference responses was the degree of possible loss which can be interpreted as the degree of threat (or opportunity) offered by the risky situation.

Chapter 5 examines personal risk taking in terms of evaluating risky investments that differ in their potential for gains and losses when one is considering investing 10% of his personal net wealth. Focal models are derived for each executive to explain his rankings of nine investment alternatives. Although expected return plays a dominant role as anticipated, variance plays little, if any, role in the rankings. Instead the executives placed a great deal of attention on the upside potential of the investment alternatives, especially the chance of doubling their investment or increasing it by 50% or more.

Chapter 6 examines the role that common risk components play in ranking lotteries. This study found that one's willingness to take risks can be substantially increased by holding the loss amount fixed compared with holding some other risk component such as chance of loss held fixed. This framing effect can play an important role in actual risky situations. The study also found a desire for an intermediate level of variability in possible returns rather than a preference for minimum variability as predicted by most economic theories of risk.

Part Three investigates the relationships among 16 key measures of risk propensity derived from the study, and their relationships with a wide variety of socio-economic variables such as age, executive positions, nationality, etc. This part consists of three separate chapters each of which represents a stand-alone study. The three chapters are tied together in a closing chapter that provides a managerial summary and implications.

Chapter 8 examines the measures of risk propensity derived from the standardized situations in Chapters 3-5. Two dimensions were found to underlie these measures, namely personal versus business risk and the degree of threat inherent in the risky situation. In

addition, we discovered risk averters were generally more consistent in their risk propensity than risk takers.

In Chapter 9 we investigated risk propensity as revealed in naturally occurring situations such as the holding of personal assets and debt, and as revealed in attitude scales for risk-related activities such as sensation seeking. Again we found that both a personal-business dimension and a degree of threat dimension underlay these risk propensities. In Chapters 8-9 we therefore showed two important dimensions that underlie the systematic way in which risk propensity depends upon the context of the situation under consideration.

Chapter 10 examines the relationships between the risk measures derived from the risk instruments in Chapters 3-9 and a wide variety of socio-economic variables divided into personal, financial, and business characteristics. Many stereotypes of risk taking or risk averting people are confirmed by the executive responses, while others are rejected. A strong relationship is found between taking risks and success defined in any of several ways.

Part Four consists of a single chapter that allows the reader to assess his own willingness to take risks using segments from the Risk Portfolio used in the study. This self-assessment is an important contribution because the reader can compare his own responses with the large database of executive responses collected in this study. The chapter also discusses a wide range of applications for both individual and organizational risk profiles that can be derived from the Risk Portfolio used in the book. A large proportion of the Risk Portfolio is reproduced in an appendix for the reader to use.

For reviews of *Taking Risks* see:

Contemporary Psychology, forthcoming, reviewed by Janet Sniezek.

Administrative Science Quarterly, December 1988, pp. 638-640, reviewed by Colin Camerer.

The Economic Journal, 1987, vol. 97, pp. 305-306, reviewed by Peter Grinyer.

The Journal of Risk and Uncertainty, June 1987, Vol. 54, pp. 391-394, reviewed by Soga Ewedemi.

Business, June 1986, pp. 149, reviewed by John Miller.

International Management, May 1986, Vol. 41, pp. 95, reviewed by Jules Arbose.