

July, 1987

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  
Goldring/Woldenberg Hall  
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 changes; we get mailing labels from them! Thanks!

From the Chairperson

The Decision Analysis Cluster at the New Orleans meeting was well organized and well attended. Special thanks for the organization goes to Irv LaValle, the Cluster Chair, and Peter C. Fishburn. A highlight of the meeting was the award of the Frank P. Ramsey Medal to Peter. The citation accompanying this award appears elsewhere in this issue.

Concerning other matters, I  
(cont. page 2.)

Peter C. Fishburn Awarded Frank P. Ramsey Medal

Chairperson Ralph Keeney's presentation of the Frank P. Ramsey Medal to Peter Fishburn on May 4, 1987 in New Orleans was as follows:

"The Operations Research Society Special Interest Group on Decision Analysis has established the Frank P. Ramsey Medal to honor people who have made distinguished contributions to the field of Decision Analysis. In addition to the medal, the recipient receives a check for \$1,000, which this year has been generously provided by funds from Decision Sciences Consortium, Inc. and from Decision Focus, Inc., as well as SIG funds.

"With the recommendation of the SIG Council, the Frank P. Ramsey medal is awarded this year to Dr. Peter C. Fishburn of AT&T Bell Laboratories.

"It is impossible to identify any issue in the foundations of Decision Analysis to which Peter has not contributed. His early work during the 1960's concerned stochastic and cardinal dominance analyses, followed promptly by identification of necessary and sufficient conditions for additive separability of von Neumann-Morgenstern utility functions. This work broke the ground for all subsequent developments in multiattribute utility theory. More recently, Peter has developed profound axiomatization of the foundations of the subjective-expected-utility model, significant generalizations of utility, and the concept and practice of approval voting. (cont. page 2.)

Chairperson, cont.

would like to mention future meetings, the Decision Analysis Applications Competition, and the election of officers. Currently, the SIG has an accumulated fortune in our treasury of approximately \$3,000, to which \$1,600 is added annually. As I mentioned in a previous column to the members, the Council is seeking innovative ways to use some of these funds to benefit members of the SIG. For instance, a member interested in using some of these funds to produce a "unique" session at some future meeting could outline his or her ideas, preferably in written form, to any Council Member. The proposal would be considered at the next SIG Meeting, which occurs at each national ORSA meeting.

At the New Orleans meeting, Ronald Howard of Stanford University had agreed to coordinate a Decision Analysis Applications competition. The purposes were to promote good applications of decision analysis and the discussion of applications issues. Unfortunately, we had only one submission so the competition was continued to the Washington ORSA meeting. Guidelines for submissions will be revised (e.g., a written paper meeting a specified length criterion may not be required) to facilitate the entry of good applications. Hence, if any of you thought about entering the competition, but hesitated for some reason, please let Ron know your thoughts.

In the Spring, 1987 elections, Robert Bordley and Bruce Judd were elected as new Council Members to serve three-year terms. They are replacing Warner North and Rakesh Sarin. At the St. Louis meeting, we will be close to finalizing the slate of candidates for the next election. Positions open include (cont. page 3)

Ramsey Medal, cont.

"The sum total of this year's Ramsey Medalist's published work is awesome; yet he is always generous in contributing his thoughts and ideas to colleagues and younger professionals.

"As a token of our respect and gratitude, it is my pleasure to say 'Thank you, Peter' with the Ramsey Medal."

Dr. Fishburn's acceptance of the award was not only gracious but informative; he spoke for several minutes on the genesis of his interests in the foundations of decision theory, which talk was clearly service above and beyond the call of duty in view of his many key responsibilities at this meeting: Chairing two and organizing four sessions, delivering a paper, and presenting a tutorial!

Current Officers of the SIG

The current officers of the SIG and their terms are as follows:

Past Chairperson, David Bell, term ending 1988; Chairperson, Ralph Keeney, term ending 1988; Chairperson Elect, Samuel Bodily, term ending 1988; Secretary/Treasurer, Irv LaValle, term ending, 1988.

Council Members are as follows: Elisabeth Pate-Cornell, term ending, 1988; Randy Simpson, term ending 1988; Bob Clemen, term ending 1989; Robin Keller, term ending 1989; Robert Bordley, term ending 1990; Bruce Judd, term ending 1990.

Chairperson, cont.

Vice Chairperson, Secretary/Treasurer, and two Council Members. Sam Bodily of the University of Virginia is head of the Nominating Committee. If you have any thoughts on who might be a candidate, including yourself, please contact Sam.

Ralph L. Keeney, Chairperson

Answers to Ward Edward's Quiz.

[See Vol. 6, No. 1 for question. References are to Decision Analysis and Behavioral Research, by Detlof von Winterfeldt and Ward Edwards, Cambridge University Press, 32 East 57th Street, NYC 10022 (1986)]

Q1. See pp. 274-279 of Detlof's and my book. Take a list of attributes, ranges already defined. Order them in decreasing order of importance. One version of swing weights then defines the swing from 0 to 100 on the most important dimension as 100, and asks the person to assess, on that scale, the degree of improvement obtained by swinging each less important dimension from 0 to 100. If there were 4 dimensions and an additive model were used, and the judgments were 65,25, and 10, then the weight of the most important dimension is 100/200, of the next, 65/200, and so on. Other versions of swing weights exist; I like this one. Its virtue is its simplicity and its independence of the notion of importance. (The arraying in importance is unimportant and arbitrary; any dimension can be used as the standard.) How to do consistency checks is obvious.

Q2. Decision Conferencing, invented by Cam Peterson, extensively used at DDI even now, and imported to England by Larry Phillips, who travels all over the world putting on decision conferences, is a procedure for strategic design. It constructs an additive benefit model to start with. About 5 (cont.)

Answers, cont.

levels of benefit are considered on each dimension of benefit. An additive cost model is considered. The experts assess a vector of costs (one dollar value for each cost dimension) for each level of each benefit. A computer program named DESIGN, now, I am told, available in a spiffy PC version from Scott Barclay, who used to work at DDI and now works with Larry at London School of Economics, aggregates costs and benefits; the result is a Pareto Frontier. Any points below it are obviously suboptimal. Since the design the experts had in mind when they started is almost always suboptimal, they start thinking about why. This leads to option invention, reorganization of benefit and cost structures, etc. The output is a small set of possible designs, all Pareto-optimal, for detailed study. It turns out to be a very powerful tool for managers--but requires a facilitator (Cam, Larry) and someone to work the computer while the facilitator interacts with the experts. The total time is usually 2 days; Cam charges about \$10,000 for those days; the participants receive a documentary record, prepared by DESIGN, of what they have done, as they exit from the conference room on the second day. Crude, but very effective. (see pp. 296-298 of the book.)

Q3. If an underlying physical continuum exists, assume that value (=utility) is linear with it. If not, simply assess values directly.

Q4. Nothing; they ignore it. The Flat Maximum (see all of Ch. 11 of Detlof's and my book) protects them from virtually any possibility of meaningful error. Interesting? I hope so.

Ward Edwards



THE INSTITUTE OF MANAGEMENT SCIENCES

# FACULTY IN RESIDENCE PROGRAM

OFFERS BENEFITS TO INDUSTRY, GOVERNMENT AND UNIVERSITIES

The TIMS Faculty-in-Residence Program was created to help organizations in industry and government arrange short-term (six months to a year) full time assignments for university professors to work on special projects for host organizations at the hosts' headquarters.

TIMS acts as a "matchmaker", listing applicants from universities and prospective employers from government and industry. The TIMS office puts interested employers in touch with listed faculty whose skills and availability match host project needs. There is no charge for this service. Prospective hosts and faculty applicants communicate directly with each other to agree on assignments, compensation, and other necessary details.

To participate in the program, one need only fill out the application and mail it to TIMS. There is no obligation. All applications will be processed promptly, and applicants will be notified of potential "matchups" that are identified.

## The Program Offers Attractive Benefits:

- Host organizations obtain fresh, high level expertise at in-house pay scales rather than high consulting rates.
- Resident faculty gain experience with corporate life that can be brought back to universities and students.
- Special projects get dedicated attention from academics with skills and credentials in the appropriate field.
- Special project needs are met without permanent headcount increases.
- Host staffs have opportunities to work closely with experts who teach the professional state of the art.
- Host organizations and universities can develop closer relationships, positively impacting future projects and recruiting/placement efforts.
- Both sides can collaborate to positively influence teaching programs, for the betterment of the professional and the world.

For more information on the Faculty-in-Residence Program,  
contact Mary R. DeMelim, Executive Director  
TIMS, 290 Westminster Street, Providence, RI 02903  
or call (401)274-2525.

# FACULTY IN RESIDENCE PROGRAM

EMPLOYER FORM

NAME OF ORGANIZATION \_\_\_\_\_  
DEPARTMENT/DIVISION \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_  
TYPE OF INDUSTRY: \_\_\_\_\_

### EXPERTISE AREA REQUIRED:

- |   |   |   |
|---|---|---|
| <input type="checkbox"/> Applied Probability and Statistics           | <input type="checkbox"/> Computer Science/MIS/AI/Decision Support |   |
| <input type="checkbox"/> Math Programming/Control Theory Optimization |   |   |
| <input type="checkbox"/> Decision Analysis/Reliability                | <input type="checkbox"/> Materials Management/Logistics           |   |
| <input type="checkbox"/> Simulation                                   | <input type="checkbox"/> Operations                               | <input type="checkbox"/> Transportation |
| <input type="checkbox"/> Management                                   | <input type="checkbox"/> Public Policy                            | <input type="checkbox"/> Health         |
| <input type="checkbox"/> Energy                                       | <input type="checkbox"/> Military                                 | <input type="checkbox"/> Marketing      |

CONTACT NAME \_\_\_\_\_  
Last First Middle  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_  
TELEPHONE \_\_\_\_\_

I AUTHORIZE FULL DISCLOSURE OF ABOVE INFORMATION-SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_

MAIL TO: TIMS, 290 Westminster Street, Providence, RI 02903.

# FACULTY IN RESIDENCE PROGRAM

FACULTY APPLICANT FORM

NAME \_\_\_\_\_  
Last First Middle  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_  
OFFICE PHONE \_\_\_\_\_ HOME PHONE \_\_\_\_\_  
PRESENT POSITION \_\_\_\_\_  
DEGREES \_\_\_\_\_  
HONORS \_\_\_\_\_  
EXPERIENCE OUTSIDE ACADEMIA, CONSULTING OR FULL TIME: \_\_\_\_\_

### FIELDS OF EXPERTISE:

- |   |   |   |
|---|---|---|
| <input type="checkbox"/> Applied Probability and Statistics           | <input type="checkbox"/> Computer Science/MIS/AI/Decision Support |   |
| <input type="checkbox"/> Math Programming/Control Theory Optimization |   |   |
| <input type="checkbox"/> Decision Analysis/Reliability                | <input type="checkbox"/> Materials Management/Logistics           |   |
| <input type="checkbox"/> Simulation                                   | <input type="checkbox"/> Operations                               | <input type="checkbox"/> Transportation |
| <input type="checkbox"/> Management                                   | <input type="checkbox"/> Public Policy                            | <input type="checkbox"/> Health         |
| <input type="checkbox"/> Energy                                       | <input type="checkbox"/> Military                                 | <input type="checkbox"/> Marketing      |

CITIZENSHIP \_\_\_\_\_ U.S. RESIDENCY STATUS \_\_\_\_\_  
AVAILABILITY: Starting When \_\_\_\_\_ For How Long \_\_\_\_\_  
GEOGRAPHIC LIMITATIONS \_\_\_\_\_  
OTHER LIMITATIONS \_\_\_\_\_

I AUTHORIZE FULL DISCLOSURE OF ABOVE INFORMATION-SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_

MAIL TO: TIMS, 290 Westminster Street, Providence, RI 02903.

Reports Received

From Yutaka Nakamura, Department of Precision Engineering, Osaka University, 2-1 Yamada-Oka, Osaka 565, JAPAN:

Risk Attitudes from Nonlinear Measurable Utility.

This paper concerns SSB utility theory in the monetary context. It introduces a measure of risk aversion and establishes necessary and sufficient conditions for comparative risk aversion. Nonseparable decompositions of an SSB utility function, which have a general form as  $\phi(x,y) = w(x)w(y)f(x-y)$ , are examined. Risk properties such as constant risk aversion and delta property are shown to give specific functional forms of an SSB utility function.

From Richard Engelbrecht-Wiggans, College of Commerce and Business Administration, the University of Illinois, 350 Commerce Bldg (West), 1206 South Sixth Street, Champaign, Illinois 61820:

The Effect of Regret on Optimal Bidding in Auctions.

While most models of auctions and competitive bidding assume that each bidder's utility for an outcome depends only on his own profit, we allow the utility to also depend on any regret that a bidder suffers after the fact, for example over "money left on the table" in Federal offshore oil lease sales. Typically, for risk neutral bidders who, after the fact, know the winner's price for the object, a bidder's optimal bidding strategy will not depend on the relative weight given to profit versus regret. However, if losers do not learn the winner's price, then the bidder's reactions to regret hurts the bid-taker at equilibrium. Thus, the existing models' exclusion of regret from risk neutral bidders' utility functions affects the applicability of the resulting theory only under certain, now clearly delineated, conditions.

Revenue Equivalence in Multi-Object Auctions.

The theory of auctions and competitive bidding suggests that, under certain conditions, seemingly different auction mechanisms result in the same expected cost or revenue to the bid-taker. In particular, the existing results assume bidders 1) to be risk neutral, 2) to obtain private information only by observing independently distributed signals, 3) to face only the two possible outcomes of "win" and "lose", and 4) to bid as if they were following Nash equilibrium bidding strategies. Under such conditions, the differences in how bidders bid in response to different pricing rules offsets the differences in the rules themselves.

The extent to which such a theory predicts what actually happens in the real world depends on how well the theory models the essence of the actual situations, and on how sensitive the theory is to its assumptions. The literature has already established two of the assumptions--that of risk neutrality and that of independent signals--to be pivotal. This paper examines a third assumption.

In particular, we allow each bidder to be faced by more than two possible outcomes; for example, a bidder may be allowed to win any subset of the objects offered for sale. Then, for risk neutral bidders with independent private values (for each possible outcome), the expected revenue or cost to the bid-taker at equilibrium depends only on 1) the number of bidders, 2) the distribution of each bidder's values, 3) the relationship between bidders' values and who wins what, and 4) the bidder's expected payments in some benchmark case. This establishes that revenue equivalence is not sensitive to the number of possible outcomes faced by each bidder.

From Richard Engelbrecht-Wiggans, College of Commerce and Business Administration, The University of Illinois, 350 Commerce Bldg (West), 1206 South Sixth Street, Champaign, Illinois 61820, and Stephen T. Mennemeyer, Abt Associates, Inc. (address requests to Dr. Engelbrecht-Wiggans):

Designing an Auction to Demonstrate and Evaluate Competitive Bidding as Method for Pricing Clinical Laboratory Services.

This paper illustrates the practice of operations research. The problem: design the experimental competitive bidding mechanism to be used in a multi-million dollar demonstration and evaluation of competitive bidding as a method for pricing clinical laboratory services provided to Medicare patients. If the demonstration proceeds as initially conceived, this competitive mechanism will price about 250 million dollars worth of services.

Our model of this problem, and the proposed solutions are developed in stages. This paper presents and discusses the objectives and constraints of the model. We also recap the main stages through which the final solution developed. An example illustrates the final proposal.

From Charles M. Harvey, International Institute for Applied Systems Analysis, A-2361 Laxenburg, AUSTRIA:

Special Conditions on Tradeoffs.

This paper discusses prescriptive models for an individual's or society's tradeoffs between different objectives. These objectives may refer to different attributes, different time-periods, or different individuals. Conditions on tradeoffs are shown to imply additive value functions that are sufficiently structured to be tractable in applications and are sufficiently general to represent preference issues concerning equity between the objectives and the dependence of tradeoffs on status quo positions.

From Adam Brandenberger, Churchill College, Cambridge University, and Eddie Dekel, Department of Economics, University of California, Berkeley, California 94720 (address requests to Professor Dekel):

Subjective Expected Utility, Admissibility, and Posterior Rationality.

This paper provides an axiomatic characterization of preferences under uncertainty which satisfy two criteria of importance in game theory: admissibility and posterior rationality. An act is admissible if it is not weakly dominated. A strategy is sequentially rational (Kreps and Wilson (1982)) if it is optimal at every information set in a tree. Posterior rationality is a weakening of sequential rationality to require optimality only at information sets which are possible under the strategy in question. A representation theorem in terms of lexicographic subjective expected utility is given.

An Axiomatic Approach to Refinements of Nash Equilibrium.

This paper provides an axiomatic characterization of preferences under uncertainty which are represented by a lexicographic hierarchy of subjective probabilities over the state space, and a utility function over the set of consequences. This representation is then used to characterize Nash, perfect and proper equilibria. The distinction between Nash equilibrium and its refinements is in terms of the state independence axiom--refinements result from strengthening this axiom from an almost everywhere to an everywhere requirement. The strengthening implies that preferences satisfy two criteria of importance in the refinements program: admissibility and posterior rationality. Admissible acts are not weakly dominated. Posterior rationality requires optimality of a strategy at all information sets (which are possible under the strategy in question).

From Peter C. Fishburn, AT&T Bell Laboratories, 600 Mountain Avenue, Murray Hill, New Jersey 07974:

Human Decision Making and Ordered Sets.

This article selectively surveys the ubiquitous role of ordered sets in human decision making. Its emphasis is on quantitative representations and associated mathematical structures that arise in the theories of preference, utility, subjective probability, decision under risk, and social choice. Algorithmic constructions, uniqueness in finite-set measurement, and choice theory for nontransitive relations are included.

Utility and Subjective Probability. (Chapter 40 in the HANDBOOK OF GAME THEORY WITH ECONOMIC APPLICATIONS, edited by Robert J. Aumann and Sergiu Hart)

From Peter C. Fishburn, and A.M. Odlyzko, AT&T Bell Laboratories, 600 Mountain Avenue, Murray Hill, New Jersey 07974:

Unique Subjective Probability on Finite Sets.

Let  $A_n$  be the family of all subsets of  $\{1, 2, \dots, n\}$  and  $p$  a probability measure on  $A_n$ . We say that  $p$  uniquely agrees with a



comparative probability relation  $>$  on  $A_n$  if, for all A and B in  $A_n$ ,  $A > B$  if and only if  $p(A) > p(B)$ , and  $p$  is the only measure with this representation. The set of probability measures that uniquely agree with some  $>$  on  $A_n$  is small for small  $n$  but grows rapidly and even for modest  $n$  has an amazing number and variety of members.

Consider, for example, the uniquely agreeing measures for  $n=10$  whose point probabilities satisfy  $0 < p_1 < p_2 < \dots < p_{10}$ . There are more than 115 million such measures for which each  $p_j$  for  $j > 2$  is a sum of some of the  $p_i$  for  $i < j$ , and many more than this for which some  $p_j$  for  $j > 2$  is not a sum of some of the  $p_i$   $i < j$ . The value of  $p_1$  can be as small as 0.000248, and  $p_2/p_1$  can be as large 88.

From Peter C. Fishburn, AT&T Bell Laboratories, 600 Mountain Avenue, Murray Hill, New Jersey, 07974 and Irving H. LaValle, A.B. Freeman School of Business, Tulane University, New Orleans, Louisiana 70118 (Address requests to Dr. Fishburn).

#### State-Dependent SSB Utility.

Axioms for preference on lottery acts are shown to imply a utility model that is additive over states and represents within-state preferences by skew-symmetric bilinear functionals specific to each state. Additional axioms lead to unique subjective probabilities for the states.

#### The Structure of SSB Utilities for Decision Under Uncertainty.

This paper concerns the structure of a skew-symmetric bilinear functional for the representation of preferences in a typical lottery-acts formulation for decision under uncertainty. It presents an alternative to the approach developed by Fishburn (1984) that we suggest is both more revealing and more elegant mathematically than the earlier approach.

From Irving H. LaValle, A. B. Freeman School of Business, Tulane University, New Orleans, Louisiana 70118, and Peter C. Fishburn, AT&T Bell Laboratories, 600 Mountain Avenue, Murray Hill, New Jersey 07974 (address requests to Dr. LaValle):

#### Transitivity in the Small and in the Large for States-Additive SSB Utilities.

Starting with induced state-conditional preferences for an additive and potentially state-dependent SSB utility model, we investigate the effects of transitive preferences on various supersets of a set of available lottery acts. Sufficient richness of the act set forces transitive preferences to be fully linear; failing such richness, transitive but nonlinear preferences may obtain.

From **Ralph L. Keeney**, 101 Lombard St., Suite 704W, San Francisco, California 94111:

- (1) Identifying and Structuring Values
- (2) Hierarchies of Objectives
- (3) Creating Alternatives Using Value-Focused Thinking
- (4) Insights from Value Assessments

Value focused thinking is a simple concept. It entails first thinking about which you want (for yourself, your family, your company, your community, your country, or for everyone) and second thinking about how to get it. In short, values first and alternatives second as a means to achieve values.

Conventional thinking, usually, and conventional analyses, almost always, proceed differently. They conceive alternatives first and values second to evaluate alternatives. Evaluation is important, but this can be done iteratively after trying to create better alternatives to evaluate. The only reason to care at all about alternatives is for the degree to which they achieve your values, so beginning in difficult problems with serious thought about your values seems potentially very useful.

From **Robert F. Bordley**, Societal Analysis Dept., General Motors Research Laboratories, 12th and Mound Sts., Warren, Michigan 48090-9055:

The Cost of Delayed Lottery Resolution.

Expected utility theory implies that the utility of a lottery whose resolution has been delayed need not equal the expected utility of that lottery's consequences, if intervening decisions are made while awaiting that lottery's resolution. This paper deduces exact formulas for the utility of such a lottery when the consequences are relatively small. We find that our formula for the utility of such a lottery exhibits many of the effects that Bell labelled disappointment and elation. Hence time-delayed lotteries may offer one possible solution to the effects noted by Kahneman and Tversky.

Linear Forecasts with an Intercept: A Bayesian Approach.

Granger and Ramanathan proposed that the optimal linear combination of forecasts involves an intercept term and unnormalized weights. In this paper, we show that we can deduce that formula from a Bayesian formulation. This derivation indicates that the Granger and Ramanathan formula is equivalent to a weighted average of the  $n$  expert forecasts plus the decision maker's prior forecast.

Inertia and Habit-Persistence (or the Dieter's Delemma).

This paper shows that cyclical consumption behavior can arise even if an individual values the future as much as he values the

present. In our case, this arises because of the presence of both habituation (utility depending upon the integral of past consumption) and inertia (utility depending upon the rate at which current consumption changes). This enables economic theory to model seemingly irrational behavior.

One Person/One Vote is Not Efficient Given Information on Factions.

This paper assumes that an efficient voting scheme will -- given information on individual votes for or against some candidate--choose that candidate which maximizes the expected value of the Harsanyi average utility social welfare function. Given no correlations among utilities, this criterion leads to one person/one vote. Given correlations among utilities, i.e. information on factions, this criterion leads to a weighted voting scheme. Essentially individuals who are moderately correlated with one another get greater weight than either individuals who are strongly correlated or mildly correlated with one another.

The Energy Function in Optimal Control Theory.

This paper defines a function, analogous to the energy function in Physics. Applied to Optimal Control Problems, momentum turns out to be the Lagrangian multiplier corresponding to the constraint relating the change in the state variable to the control variable. Pontryagin's Principle implies that the energy function satisfies a series of differential equations--which are the analogues of Hamilton's Equations in Physics. Energy is the optimal value of the Objective function.

The Bayesian Estimate of the Cauchy Centering and Scaling Parameters.

This paper assumes we have  $n$  forecasts with Independent and identically distributed Cauchy forecast errors. We assume non-informative priors on the centering and scaling parameters and deduce the resulting Bayesian estimates of the Cauchy centering and scaling parameters. The mathematics involved is extremely complicated. The resulting formula weights each observation by a function of its distance from every other observation. Outliers are heavily discounted. Indeed the Bayesian center of the observations  $-10 -1 0 1 2$  is more positive than the Bayesian center of the observations  $-2 -1 0 1 2$  since the formula discounts the  $-10$  so heavily. Thus monotonicity doesn't hold. Also the form of the weights changes significantly depending upon whether the number of observations is odd or even.

Convex Indirect Utility Functions from Concave Utilities.

In this paper, we impose a number of intuitive properties: concave direct utility, first-order conditions sufficient for optimality, consumption always increasing in income. We assume that our budget constraint is nonlinear. We find that these conditions imply

a convex indirect utility function (i.e. utility a convex function of wealth) if the direct utility function includes expectations and if the rate of interest increases with the amount of money borrowed or lent. Thus diminishing marginal utility of income need not hold.

[The subsequent work address the apparent conflict between the probability theory implied by quantum mechanics and the standard probability theory used in all other scientific disciplines. Bayesian probability theory generally implies that the standard probability theory mathematics is appropriate. Hence the probability theory used in quantum mechanics presents a problem for Bayesians. As a result, I have been trying to develop models of quantum phenomena using the standard probability theory and not the quantum probability theory.]

#### An Intuitive Form of Nonlocalism for Quantum Mechanics.

This paper assumes that an electron's path need not follow a straight-line. We show that this assumption alone can explain the interference effects noted in the n-slit interference experiment. It leads to effects which are usually considered non-local. Hence we show that nonlocalism need not reflect physically uniuitive assumptions.

#### The Sum of Two Bell-Shaped Curves can be Sinusoidal.

This paper considers the n-slit interference experiment and presents a density which is bell-shaped. However, if we take the sum of two such densities, each centered at points  $-x$ , and  $+x$  respectively, we get sinusoidal interference fringes. Hence it is not true that quantum interference fringes -- considered in isolation from destructive interference -- constitute a refutation of standard probability theory.

#### Higher Derivatives of Velocity and Quantum Mechanics.

This paper develops a model of the particle as minimizing a Lagrangian which contains terms involving acceleration. Solving this model leads to a cyclical trajectory for the particle. We then assume that we neglect the acceleration-dependent portion of the Lagrangian and compute the resulting errors. The probability description describing the particle's path does explain the 2-slit interference experiment. Hence we see that one possible explanation of quantum effects is the existence of a previously neglected acceleration-term in the Lagrangian. We conjecture that attempting to adjust for these effects by explicitly measuring a particle's initial acceleration should reduce the uncertainty in our predictions of particle motion.

Recently a comment appeared in Physics Letters supporting this conjecture on theoretical grounds.