

ROBERT F. NAU

Revised January 2012

ADDRESS:

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EDUCATION:

University of California, Berkeley
Ph.D. in Engineering Science, 1981 (M.S. 1978)
Major Field: Operations Research
Minor Fields: Electrical Engineering, Statistics

Dissertation topic: "Coherent Assessment of Subjective Probability". Dissertation Committee: Richard Barlow & Ilan Adler (IEOR Department, U.C. Berkeley), David Blackwell (Statistics Department, U.C. Berkeley)

University of California, San Diego
B.A. in Physics, High Honors, 1975

EXPERIENCE:

2007-	<i>Professor</i>
1989-2007	<i>Associate Professor</i>
1985-1989	<i>Assistant Professor</i>
	Fuqua School of Business, Duke University, Durham, North Carolina
1999 and 2001	<i>Visiting Professor</i>
	INSEAD, Fontainebleau, France
1983-1985	<i>Assistant Professor</i>
	A.B. Freeman School of Business, Tulane University, New Orleans, Louisiana
1981-1983	<i>Manager of Information Systems</i>
	National Risks Department, Liberty Mutual Insurance Company, Boston, Massachusetts

PUBLICATIONS:

- Nau, R.F. (2011) Risk, Ambiguity, and State-Preference Theory. *Economic Theory* **49**: 1, 437-467
- Nau, R.F. (2011) Imprecise Probabilities in Non-cooperative Games. *Proceedings of the Seventh International Symposium on Imprecise Probability: Theories and Applications*
- Keeney, R., and Nau, R.F. (2011) A Theorem for Bayesian Group Decisions. *Journal of Risk and Uncertainty* **43**: 1, 1-17
- Nau, R.F., Jose, V.R., and Winkler, R.W. (2009) Duality Between Maximization of Expected Utility and Minimization of Relative Entropy When Probabilities are Imprecise, *Proceedings of the Sixth International Symposium on Imprecise Probability: Theory and Applications*
- Jose, V.R., Nau, R.F., and Winkler, R.W. (2009) Sensitivity to Distance and Baseline Distributions in Forecast Evaluation. *Management Science* **55**: 4, 582-590
- Jose, V.R., Nau, R.F., and Winkler, R.W. (2008) Scoring Rules, Generalized Entropy, and Utility Maximization. *Operations Research* **56**: 5, 1148-1157
- Jose, V.R., Lichtendahl, K.C., Nau, R.F., and Winkler, R.W., "Objective Priors for the Multivariate Normal Model: Comment." (2007) In J.M. Bernardo et al., eds., *Bayesian Statistics 8*. Oxford: Oxford University Press, 557-558.
- Nau, R.F., Jose, V.R., and Winkler, R.W., (2007) Scoring Rules, Entropy, and Imprecise Probabilities. *Proceedings of the Fifth International Symposium on Imprecise Probabilities and Their Applications*
- Nau, R.F., (2007) Extensions of the Subjective Expected Utility Model. In *Advances in Decision Analysis: From Foundations to Applications*, edited by Ward Edwards, Ralph Miles, Jr., and Detlof von Winterfeldt. Cambridge University Press, 2007
- Nau, R.F. (2006) The Shape of Incomplete Preferences. *The Annals of Statistics* **34**:5, 2430-2448
- Nau, R.F. (2006) Uncertainty Aversion With Second-Order Utilities and Probabilities. *Management Science* **52**:1, 136-145
- Nau, R. F., S. Gomez Canovas and P. Hansen (2004) On the Geometry of Nash Equilibria and Correlated Equilibria. *International Journal of Game Theory* **32**, 443-453

- Nau, R.F. (2003) A Generalization Of Pratt-Arrow Measure To Non-Expected-Utility Preferences And Inseparable Probability And Utility. *Management Science* **49**:8, 1089-1104
- Nau, R.F. (2002) The Aggregation of Imprecise Probabilities. *Journal of Statistical Planning and Inference* **105**, 265-282
- Nau, R. F. (2001) De Finetti Was Right: Probability Does Not Exist. *Theory and Decision* **51**, 89-124
- Nau, R.F. (1999) Arbitrage, Incomplete Models, and Other People's Brains. In M. Machina and B. Munier (eds.) *Preferences, Beliefs, and Attributes in Decision Making*. Kluwer Academic Publishers.
- Nau, R.F., E. Grønn, M. Machina, and O. Bergland, eds. (1997) *Economic and Environmental Risk and Uncertainty: New Models and Methods*, Kluwer Academic Publishers
- Nau, R.F. (1996) Comment on "Plausible Bayesian Games" by James Q. Smith, in *Bayesian Statistics 5: Proceeding of the 5th Valencia Meeting*, edited by J. Bernardo, J. Berger, A. Dawid and A. Smith, Clarendon, 1996
- Nau, R.F. (1995) The Incoherence of Agreeing to Disagree. *Theory and Decision* **39**, 219-239
- Smith, J.E. and R.F. Nau (1995) Valuing Risky Projects: Option Pricing Theory and Decision Analysis. *Management Science* **41**:5 795-816
- Nau, R.F. (1995) Coherent Decision Analysis with Inseparable Probabilities and Utilities. *Journal of Risk and Uncertainty* **10** 71-91
- Nau, R.F. (1994) Comment on chapter on "Arbitrage Pricing, Common Knowledge Priors, and Market Completeness." In *Speculative Behavior and the Operation of Competitive Markets Under Uncertainty* by Michael A.S. Guth, Avebury 1994
- Nau, R.F. (1992) Indeterminate Probabilities on Finite Sets. *The Annals of Statistics* **20**:4 1737-1767
- Nau, R.F. (1992) Joint Coherence in Games of Incomplete Information. *Management Science* **38**:3 374-387
- Nau, R.F. and K.F. McCardle (1991) Arbitrage, Rationality, and Equilibrium. *Theory and Decision* **31** 199-240
- Nau, R.F. and K. F. McCardle (1990) Coherent Behavior in Noncooperative Games. *Journal of Economic Theory* **50**:2 424-444

Nau, R.F. (1989) Decision Analysis with Indeterminate or Incoherent Probabilities. *Annals of Operations Research* **19** 375-403

Nau, R.F. (1987) Blau's Dilemma Revisited. *Management Science* **33**:10 1232-1237

Nau, R.F. (1985) Should Scoring Rules be 'Effective'? *Management Science* **31**:5 527-535

Nau, R.F. and R.M. Oliver (1979) Adaptive Filtering Revisited. *Journal of the Operational Research Society* **30**:9 825-831

TECHNICAL REPORTS:

Nau, R.F. (1981) Coherent Assessment of Subjective Probability. ORC 81-5, Operations Research Center, U.C. Berkeley

Nau, R.F., R.M. Oliver, and K.O. Pister (1980) Simulating and Analyzing Artificial Non-Stationary Earthquake Ground Motions. ORC 80-16, Operations Research Center, U.C. Berkeley

Chang, M.K., J.W. Kwiatkowski, R.F. Nau, R.M. Oliver, and K.O. Pister (1979) ARMA Models for Earthquake Ground Motion. ORC 79-1, Operations Research Center, U.C. Berkeley

EDITORIAL ACTIVITIES:

Associate Editor for *Operations Research* 2006-

Coordinating Editor for *Theory and Decision* 2005-

Departmental Editor for *Management Science* (Decision Analysis) 1996-1998

Associate Editor for *Management Science* (Decision Analysis) 1989-1995

Contributing editor of *Decision-making Under Uncertainty: New Models and Empirical Findings* (J. Geweke, ed.), Kluwer Academic Publishers 1992

HONORS AND AWARDS:

Decision Analysis Society Publication Award for Best Paper Published in 1995 for "Valuing Risky Projects: Options Pricing Theory and Decision Analysis" (with James E. Smith)

INVITED SEMINARS:

"Scoring Rules, Generalized Entropy, and Utility Maximization," GRID/ENSAM, Paris (May 2007)

- “Scoring Rules, Generalized Entropy, and Utility Maximization,” IEOR Department, University of California at Berkeley (October 2006)
- “Game Theory, Decision Analysis, and Finance: A Synthesis”, Economics Department, Johns Hopkins University (September 2005)
- “A Generalization Of Pratt-Arrow Measure To Non-Expected-Utility Preferences And Inseparable Probability And Utility”, MEDS Department, Northwestern University (May 2002)
- “A Generalization Of Pratt-Arrow Measure To Non-Expected-Utility Preferences And Inseparable Probability And Utility” Seminaire Risque, Incertitude Et Decision, University of Paris I & VI (December 1999)
- “The Arbitrage Principle in Economics,” Economics and Philosophy Seminar, École Normale Supérieure de Paris (December 1999)
- “A Generalization Of Pratt-Arrow Measure To Non-Expected-Utility Preferences And Inseparable Probability And Utility” workshop on subjective probability, University of Paris-Dauphine (June 1999)
- “A Generalization of the Pratt-Arrow Measure” presented in the Operational Research seminar at the London School of Economics (May 1999)
- “Nash Equilibria are Superficial Correlated Equilibria,” Discrete Applied Mathematics/Game Theory seminar at the London School of Economics (May 1999)
- “Arbitrage Choice Theory: Beyond Preferences and Consequences,” Economics Department, University of Exeter (May 1999)
- “The Arbitrage Theory of Rational Choice,” Hong Kong University of Science and Technology (August 1998)
- “The Arbitrage Theory of Rational Choice,” E.N.S. Cachan/U. Paris VI/ESSEC/E.N.P.C. Inter-University Seminar on Decision Sciences, École Normale Supérieure de Cachan (April 1998)
- “Arbitrage, Incomplete Models, and Interactive Rationality”, INSEAD (April 1998)
- “Arbitrage and Game Theory” Economics Department, University of California at San Diego (May 1997)
- “Arbitrage, Incomplete Models, and Interactive Rationality”, Anderson Graduate School of Management, UCLA (February 1997)
- “Duality, Probabilistic Satisfiability, and Game Theory,” GERAD (Group for Research in Decision Analysis), École Polytechnique de Montréal (January 1997)

- “The Volatility of Beliefs”, Department of Economics, Finance, and Legal Studies, University of Alabama (November, 1996)
- “Arbitrage and Game Theory”, UNC Operations Research Colloquium (January 1996), Norwegian School of Economics and Business Administration, Bergen (February 1996), Agricultural University of Norway, Ås (February 1996), Stockholm School of Economics (February 1996), and the University of Copenhagen, Economics Institute (February 1996)
- “Valuing Risky Projects: Option Pricing Theory and Decision Analysis”, Norwegian School of Management, Oslo (February 1996)
- “Coherent Decision Analysis with Inseparable Probabilities and Utilities,” Department of Statistics, Carnegie Mellon University (November 1994)
- “Rationality Within and Without,” Darden Graduate School of Business, University of Virginia (November 1994)
- “Arbitrage, Rationality, and Equilibrium,” International workshop on Uncertainty Representation and Decision Making (an invited main speaker), Toulon, France (March 1992)
- “Arbitrage, Rationality, and Equilibrium,” INSEAD, Fontainebleau, France (March 1992)
- “The Incoherence of Agreeing to Disagree,” Penn State University Conflict/Negotiation Workshop (November 1990)
- “Arbitrage, Rationality, and Equilibrium,” Economics Department, Virginia Tech (October 1990)
- “Arbitrage, Rationality, and Equilibrium,” Federal Reserve Bank of Atlanta/Emory University Workshop on Money, Banking, and Finance (April 1990)
- “Coherent Behavior in Noncooperative Games,” Operations Research Department, U.C. Berkeley, (January 1988)

FUNDED RESEARCH:

Principal investigator, “Arbitrage and Rational Choice,” National Science Foundation, awarded \$56,348 for 1998-2000

Co-principal investigator (with Prof. Daniel Richter, School of the Environment), "Statistical and Time Series Analysis of Long-term Suspended Sediment Concentrations and Yields in the Yadkin River Basin NC", Water Resources Research Institute (UNC), awarded \$39,272 for 1992-93

Principal investigator, "Theory and Applications of Fuzzy Subjective Probabilities," National Science Foundation, awarded \$29,964 for 1985-86

PRESENTATIONS AT NATIONAL AND INTERNATIONAL MEETINGS:

- “Imprecise Probabilities in Non-cooperative Games,” presented at the Second Symposium on Games and Decisions in Reliability and Risk, Belgirate, Italy, May 19-21, 2011 (invited speaker), and at the Seventh International Symposium on Imprecise Probability: Theories and Applications, Innsbruck, Austria, July 25-28, 2011
- “Risk, Ambiguity and State-Preference Theory,” presented at the Workshop on Risk, Ambiguity, and Decisions in Honor of Daniel Ellsberg, Institute for Advanced Studies, Vienna, May 10-12, 2010
- “Duality Between Maximization of Expected Utility and Minimization of Relative Entropy When Probabilities are Imprecise”, presented at the Sixth International Symposium on Imprecision Probability: Theory and Applications, Durham, United Kingdom, July 14-18, 2009
- “Scoring Rules, Entropy, and Imprecise Probabilities” presented at the Fifth International Symposium on Imprecise Probabilities and Their Applications, Prague, July 16-19, 2007
- “Coherent Cooperation” presented at the Philosophy of Science Association Meeting, Vancouver, November 2-6, 2006, and at the 13th International Conference on Foundations and Applications of Utility, Risk, and Decision Theory (FUR XIII) in Barcelona, July 2-5, 2008
- “Scoring Rules, Generalized Entropy, and Utility Maximization,” presented at the Valencia/ISBA Eighth World Meeting on Bayesian Statistics, Benidorm, Spain, June 1-7, 2006, and at the 12th International Conference on Foundations and Applications of Utility, Risk, and Decision Theory (FUR XII) in Rome, June 22-26, 2007
- “Game Theory, Decision Analysis, and Finance: A Synthesis,” presented at the INFORMS San Francisco Meeting, November 13-16, 2005
- “Syndicates, Opinion Pools, and State-Dependent Utility,” presented at the Triennial Conference of the International Federation of Operational Research Societies (IFORS) in Honolulu, July 11-15, 2005
- “Bayesianism Without Priors, Acts Without Consequences,” presented at the Eleventh International Conference on the Foundations and Applications of Utility, Risk, and Decision Theory (FUR XI) , Paris, June 30-July 4, 2004; at the INFORMS Denver Meeting, October 24-27, 2004; at the Workshop on Risk, Utility, and Decision (RUD 2005), Heidelberg, June 22-24, 2005; and at the 4th International Symposium on Imprecise Probabilities and Their Applications (ISIPTA '05), Carnegie Mellon University, Pittsburgh, July 20-23, 2005
- “On the Geometry of Nash Equilibria and Correlated Equilibria” presented at the Second World Congress of the Game Theory Society (GAMES 2004), Marseille, July 5-9, 2004

- “Uncertainty Aversion With Second-Order Utilities and Probabilities,” presented at the Second International Symposium on Imprecise Probabilities and their Applications (ISIPTA '01), Cornell University, June 26-29, 2001; at the INFORMS Miami Beach Meeting, November 3-7, 2001; at the Workshop on Risk, Uncertainty, and Decision (RUD 2002), Gif-sur-Yvette, France, June 5-7, 2002; and at the Joint Statistical Meetings, New York, August 11-15, 2002, and at the Ninth Behavioral Decision Research in Management Conference (BDRM), Fuqua School of Business, Duke University, April 15-18, 2004
- “De Finetti Was Right: Probability Does Not Exist,” invited plenary lecture presented at the Tenth International Conference on the Foundations and Applications of Utility, Risk, and Decision Theory (FUR X), Turin, Italy, May 30-June 2, 2001
- “Arbitrage Choice Theory: Beyond Preferences And Consequences,” presented at the 17th International Meeting on Subjective Probability, Utility, and Decision Making (SPUDM 17), Mannheim, Germany, August 9-11, 1999
- “The Aggregation of Imprecise Probabilities” presented at the First International Symposium on Imprecise Probabilities and their Applications (ISIPTA '99), Ghent, Belgium, June 30-July 2, 1999
- “A Generalization Of Pratt-Arrow Measure To Non-Expected-Utility Preferences And Inseparable Probability And Utility” presented at the 9th International Conference on Foundations and Applications of Utility, Risk, and Decision Theory (FUR IX), Marrakech, Morocco, June 1-4, 1999, and at the INFORMS San Antonio National Meeting, November 5-9, 2000
- “Nash Equilibria are Superficial Correlated Equilibria” presented at the Southeast Economic Theory Conference, University of North Carolina, Chapel Hill, November 14-15 1997; at the INFORMS Montreal Meeting, April 26-29, 1998; and at the Eighth International Symposium on Dynamic Games and Applications, Maastricht, The Netherlands, July 5-8, 1998
- “Arbitrage, Incomplete Models, and Interactive Rationality” presented at the 35th Bayesian Research Meeting, Los Angeles, February 19-22, 1997; at the INFORMS San Diego Meeting, May 4-7, 1997; and at the 8th International Conference on Foundations and Applications of Utility, Risk, and Decision Theory, Mons, Belgium, July 2-5 1997.
- “The Volatility of Beliefs” presented at the INFORMS National Meeting, New Orleans, October 29-November 1, 1995
- “Coherent Behavior in Noncooperative Games” presented at the International Conference on Game Theory and Applications in Honor of Robert Aumann, Jerusalem, June 25-29, 1995
- “Rationality Within and Without” presented at the ORSA/TIMS Joint National Meeting, Detroit, October 23-26, 1994
- “The Shape of Incomplete Preferences” presented at the TIMS/ORSA Joint National Meeting, Boston, April 24-27, 1994; and at the Workshop on Model Elaboration,

Sensitivity and Robustness, Royal Academy of Sciences, Madrid, June 1994; and at the Fifth International Meeting on Bayesian Statistics (Valencia 5), Alicante, July 1994; and at the 7th International Conference on Foundations and Applications of Utility, Risk, and Decision Theory (FUR VII), Oslo, July 1994. Revised version presented at the Third International Symposium on Imprecise Probabilities and Their Applications (ISIPTA '03), Lugano, July 14-17, 2004

“Bayesian Behavior in Noncooperative Games” presented at the 45th NSF/NBER Seminar on Bayesian Inference in Econometrics and Statistics, Duke University, November 13, 1992

“Subjectivity and Asset Pricing” presented at the TIMS/ORSA Joint National Meeting, San Francisco, November 1-4, 1992

“The Relativity of Subjective and Objective Correlated Equilibria” presented at the TIMS/ORSA Joint National Meeting, Orlando, April 27-29, 1992, and at the Sixth International Conference on Foundations and Applications of Utility, Risk, and Decision Theory (FUR VI), Paris, June 15-18, 1992, and at the Workshop on Knowledge and Game Theory, Stony Brook NY, July 20-24, 1992

“Coherent Decision Analysis with Inseparable Probabilities and Utilities” presented at the ORSA/TIMS Joint National Meeting, Anaheim, November 3-6, 1991, and at the 29th Bayesian Research Conference, Los Angeles, February 14-15, 1991

“The Incoherence of Agreeing to Disagree” presented at the TIMS/ORSA Joint National Meeting, Nashville, May 12-15, 1991, and at the International Conference on Game Theory and Economics at SUNY Stony Brook, July 15-18, 1991, and at the Southeast Economic Theory and International Trade Meeting, University of Virginia, November 4-6, 1994

“Arbitrage, Rationality, and Equilibrium” presented at the ORSA/TIMS Joint National Meeting, Philadelphia, October 29-31, 1990, and at the Fifth International Conference on Foundations and Applications of Utility, Risk, and Decision Theory (FUR V), Duke University, June 9-13, 1990

“Joint Coherence in Games of Incomplete Information” presented at FUR V, June 1990, and at the International Conference on Game Theory and Economics, SUNY Stony Brook, July 10-14, 1990. Earlier versions presented at the ORSA/TIMS Joint National Meeting in Denver, October 24-26, 1988; at the ASSA/Econometrics Society Meeting in New York, December 28-30, 1988; and at the Southeast Economic Theory and International Trade Conference, University of North Carolina, September 22-24, 1989

“Indeterminate Probabilities and Utilities on Finite Sets” presented at FUR V, June 1990

“Ambiguity and Paradoxes of Choice Under Uncertainty” presented at the EURO/TIMS International Meeting, Paris, July 6-8, 1988, and at the ORSA/TIMS Joint National Meeting, New York, October 16-18, 1989.

“Coherent Behavior in Noncooperative Games” presented at the TIMS/ORSA Joint National Meeting, Washington D.C., April 25-27, 1988

“Ambiguity and Problem Structuring” presented at the ORSA/TIMS Joint National Meeting, St. Louis, October 25-28, 1987

“A New Theory of Indeterminate Probabilities and Utilities” presented at the TIMS/ORSA Joint National Meeting, New Orleans, May 4-6, 1987; also presented at the NSF/NBER Seminar on Bayesian Inference in Econometrics, Duke University, April 24-25, 1987

“A Comparison of Models for Ambiguous Probabilities” presented at the ORSA/TIMS Joint National Meeting, Miami, October 27-29, 1986

“Reconciling Incoherence and Combining Judgments with Fuzzy Probabilities” presented at the TIMS/ORSA Joint National Meeting, Los Angeles, April 14-16, 1986

“Decision Analysis with Fuzzy Probabilities and Utilities” presented at the TIMS/ORSA Joint National Meeting, Boston, April 29-May 1, 1985

“The Duality of Fuzzy Probabilities” presented at the ORSA/TIMS Joint National Meeting, Dallas, November 26-28, 1984

“Should Scoring Rules be 'Effective'?” presented at the ORSA/TIMS Joint National Meeting, San Francisco, May 14-16, 1984

“Scoring Rules which are Strictly Proper and Sensitive to Distance” presented at the TIMS/ORSA Joint National Meeting, Chicago, April 25-27, 1983

OTHER PROFESSIONAL ACTIVITIES:

Member of:

Institute for Operations Research and the Management Sciences
Decision Analysis Society
American Economic Association
Game Theory Society
Society for Imprecise Probabilities and Their Applications

Referee for:

Management Science, Operations Research, Mathematics of Operations Research, Econometrica, American Economic Review, Journal of Economic Theory, Annals of Statistics, Journal of the American Statistical Association, Mathematical Social Sciences, National Science Foundation, etc.

Co-organizer (together with Luca Rigotti and Philipp Sadowski) of the 2009 international meeting on Risk, Uncertainty, and Decision (RUD 2009), held at Duke University, June 18-21, 2009

Program Committee Board (organizing committee) for 4th International Symposium on Imprecise Probabilities and Their Applications (ISIPTA '05), Carnegie Mellon Univ.

Information Officer and founding web site editor for Decision Analysis Society of INFORMS, 1995-2007

Secretary/Treasurer, Decision Analysis Section of INFORMS, 1994-1998

Council Member, Decision Analysis Special Interest Group of ORSA, 1992-94

Advisory Board Member: Statistical Graphics Corporation, Princeton, New Jersey

Track co-chair, TIMS/ORSA Orlando Meeting, April 26-29, 1992 (Decision Analysis track)

Member of the National Organizing Committee, Fifth International Conference on Foundations and Applications of Utility, Risk, and Decision Theory, June 9-13, 1990

Track chair, International Symposium on Forecasting, Boston, May 26-29, 1987 (Software track)

Sessions organized at INFORMS/ORSA/TIMS Joint National Meetings:

“Decision Analysis and Game Theory” (2005, San Francisco)

“Decision Theory” (2001, Miami Beach)

“Equilibria in Games” (1998, Montreal)

“Decision Making in Markets” (1994, Boston)

"Arbitrage and Rationality" (1992, San Francisco)

"Decision Analysis and Game Theory" (1989, Vancouver)

"Modeling Fuzziness in Decision Analysis" (1985, Atlanta)

"Precision in Probability Assessment" (1984, Dallas)

TEACHING:

Fuqua School of Business, Duke University:

Choice Theory (Ph.D. seminar)

Statistical Forecasting (MBA elective)

Statistical Models (CCMBA & DGMBA core)

Decision Models (MBA and WEMBA core)

MBA and EMBA Math Review

INSEAD, Fontainebleau, France:

Rational Choice Theory (Ph.D. seminar)

A.B. Freeman School of Business, Tulane University:

Data Analysis and Forecasting

Computers and Information Systems

Decision Models I & II (Management Science)

MBA and EMBA Math Review