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NEW DIRECTIONS FOR MULTIVARIATE STATISTICAL COMPUTATION  
AND DATA ANALYSIS(U) CARNEGIE-MELLON UNIV PITTSBURGH PA  
DEPT OF STATISTICS W F EDDY ET AL 30 SEP 87

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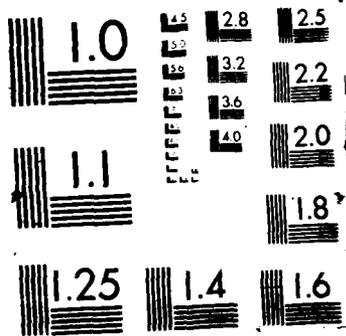
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FINAL REPORT FOR  
CONTRACT N00014-84-K-0588  
Task No. NR 042-521

"New Directions for  
Multivariate Statistical Computation  
and Data Analysis"

OFFICE OF NAVAL RESEARCH  
STATISTICS AND PROBABILITY PROGRAM  
ARLINGTON, VA 22217

Submitted by

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September 30, 1987

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### Papers Submitted to Refereed Journals (and not yet published)

- Follmann, D. Consistency and estimation for the nonparametric marginal Rasch model, 1986. Submitted to *Psychometrika*.

### Papers Published in Refereed Journals

- Eddy, W.F., Focus on the IBM Project at Carnegie-Mellon, *SIAM News*, 17, Number 4, p.8, 1984.
- Eddy, W.F., Book review of *The Handbook of Random Number Generation and Testing with TESTRAND Computer Code* by Edward J. Dudewicz and Thomas G. Ralley, 1984, *Journal of the American Statistical Association*, 79, p. 483.
- Fienberg, S.E., Comment on a paper by M. West, J. Harrison, and H.S. Migon: Dynamic generalized linear models and Bayesian forecasting, *Journal of the American Statistical Association*, 80, (1985), pp. 89-90 (with R. Tsay).
- Fienberg, S.E., Book review of *Models for Category Counts*, by B. Fingleton, in *American Scientist*, 73 (Nov.-Dec., 1985), 590-591.
- Fienberg, S.E., Comment on a paper by P. Diaconis and B. Efron: Testing for independence in a two-way table: New interpretations of the chi-square test, *Annals of Statistics* 13, (1985), 882-884.
- Fienberg, S.E., Statistical analysis of multiple sociometric relations, *Journal of the American Statistical Association*, 80, (1985), 51-67 (with M. Meyer and S. Wasserman).
- Fienberg, S.E., Risk preferences for gains and losses in multiple objective decisionmaking. *Management Science*, 32 (1986), 1065-1086 (with G.W. Fischer, M.S. Kanlet, and D. Schkade).
- Eddy, W.F., On the Number of Leaves of a Euclidean Minimal Spanning Tree (with J.M. Steele and L.A. Shepp), 1987, *Journal of Applied Probability* (to appear).
- Eddy, W.F., Book review of *Statistical Computing in Pascal*, by D. Cooke, A.H. Craven, and G.M. Clarke, 1987, *Technometrics*, 28, 123-124.

### Books (and sections thereof) Published

- Eddy, W.F., Artificial Intelligence and Statistics: Do We Have the Cart Before the Horse? (Abstract), 1985, *Computer Science and Statistics: Proceedings of the 17th Symposium on the Interface*, pp. 41 (D.M. Allen, Ed.), North Holland, Amsterdam.
- Eddy, W.F., Large-scale Workstations Networks: Implications for Teaching, 1985, *Proceedings of the Statistical Education Section, American Statistical Association*, pp. 1-3.
- Eddy, W.F., Array Processors - A Tradeoff Between Speed and Accuracy? (with A.C. Jones), 1985, *Proceedings of the Statistical Computing Section, American Statistical Association*, pp. 370-374.
- Eddy, W.F., Applications of Belief Functions to Rule-based Expert Systems (with G.P. Pei), 1985, *Proceedings of the Statistical Computing Section, American Statistical Association*, pp. 5-11.



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- Eddy, W.F., *Statistical Computing: What's Past is Prologue* (with J.E. Gentle), 1985, Chapter 10, *A Celebration of Statistics*, (A.C. Atkinson and S.E. Fienberg, eds.) pp. 233-249, Springer-Verlag, New York.
- Eddy, W.F., *Implications of Advances in Computing for Graduate Study in Statistics* (with A.C. Jones, R.E. Kass, and M.J. Schervish), 1985, *Computer Science and Statistics: Proceedings of the 17th Symposium on the Interface*, pp. 131-136 (D.M. Allen, Ed.), North Holland, Amsterdam.
- Fienberg, S.E., *Multivariate directed graphs in statistics*, in *Encyclopedia of Statistical Sciences*, Vol. 6 (S. Kotz and N.L. Johnson, eds.), (1985), Wiley, New York, 40-44.
- Fienberg, S.E., *Bayes' Theorem*, in *The Social Science Encyclopedia* (A. Kuper and J. Kuper, eds.), (1985) Routledge and Kegan Paul, London, 65.
- Fienberg, S.E., *Stochastic Models*, in *The Social Science Encyclopedia* (A. Kuper and J. Kuper, eds.), (1985) Routledge and Kegan Paul, London, 830.
- Fienberg, S.E., *Introduction: beyond the identification problem*, in *Cohort Analysis in Social Research: Beyond the Identification Problem* (Wm.M. Mason and S.E. Fienberg, eds.), (1985) Springer-Verlag, New York, 1-8 (with Wm.M. Mason).
- Fienberg, S.E., *Statistics*, in *World Book Encyclopedia*, Vol. 18, (1985), 686-688.
- Fienberg, S.E., *Statistical developments in World War II: an international perspective*, in *A Celebration of Statistics: The ISI Centenary Volume* (A.C. Atkinson and S.E. Fienberg, eds.), (1985) Springer-Verlag, New York, 25-30.
- Fienberg, S.E., *A Celebration of Statistics: The ISI Centenary Volume* (Edited with A.C. Atkinson), Springer-Verlag (1985).
- Fienberg, S.E., *Specification and implementation of age, period and cohort models*, in *Cohort Analysis in Social Research: Beyond the Identification Problem* (Wm.M. Mason and S.E. Fienberg, eds.), (1985), Springer-Verlag, New York, 45-88 (with Wm.M. Mason).
- Fienberg, S.E., *Cohort Analysis in Social Research: Beyond the Identification Problem* (Edited with Wm.M. Mason), Springer-Verlag (1985).
- Eddy, W.F., *Computers in Statistical Research* (with P.J. Huber, D.E. McClure, D.S. Moore, W. Stuetzle, and R.A. Thisted), 1986, *Statistical Science* 1, pp. 419-453 (with discussion).
- Eddy, W.F., *Discrete-finite Inference on a Network of VAXes* (with M.J. Schervish), 1986, *Computer Science and Statistics: Proceedings of the 18th Symposium on the Interface*, pp. 30-36. American Statistical Association, Washington, D.C.
- Eddy, W.F., *Parallel Architecture - A Tutorial for Statisticians*, 1986, *Computer Science and Statistics: Proceedings of the 18th Symposium on the Interface*, 23-29. American Statistical Association, Washington, D.C.
- Eddy, W.F., *Structures of Rule-Based Belief Functions* (with G.P. Pei), 1986, *IBM Journal of Research and Development*, 30, pp. 93-101.

- Eddy, W.F., Statement to the Subcommittee on Census and Population of the Committee on Post Office and Civil Service, U.S. House of Representatives, Serial No. 99-48, pp. 56-68. May 1, 1986.
- Fienberg, S.E., The Rasch Model, in *Encyclopedia of Statistical Sciences*, Vol. 7 (S. Kotz and N.L. Johnson, eds.), (1986), Wiley, New York, 627-632.
- Fienberg S.E., Comparing probability forecasters: Basic binary concepts and multivariate extensions, in *Bayesian Inference and Decision Techniques: Essays in Honor of Bruno de Finetti* (P.K. Goel and A. Zellner, eds.), North-Holland Publishing Co. (1986), 247-264 (with M.H. DeGroot).
- Fienberg, S.E., Adjusting the census: Statistical methodology for going beyond the count. *Proceedings of Bureau of the Census Second Annual Research Conference* (1986), U.S. Department of Commerce, Washington, D.C., 570-577.
- Fienberg, S.E., Misunderstanding beyond a reasonable doubt. Comment on Cohen, *Boston University Law Review*, **66** (1986), 651-656.
- Fienberg, S.E., Gatecrashers, blue buses, and the Bayesian representation of legal evidence, *Boston University Law Review*, **66** (1986), 693-700.
- Fienberg, S.E., Forging a role for statistics in science and public policy in Canada, *Liaison*, **1**, (1986), No. 2, 42-45.
- Fienberg, S.E., The relevance of Bayesian inference for the presentation of statistical evidence and for legal decisionmaking. *Boston University Law Rev.*, **66** (1986), 771-798 (with M.J. Schervish).
- Eddy, W.F., Graduate Education in Computational Statistics (with A.C. Jones, R.E. Kass, and M.J. Schervish), 1987, *The American Statistician*, **41**, 60-64.
- Eddy, W.F., Approximating Belief Functions in a Rule-based System, 1987, *Proceedings of the First International Conference on Statistical Computing* (to appear).
- Eddy, W.F., Parallel Computing on a Network of Vaxes with Applications (with M.J. Schervish), 1987, *Proceedings of the Statistical Computing Section, American Statistical Association*, (to appear).
- Eddy, W.F., Graduate Education in Computational Statistics (with A.C. Jones, R.E. Kass, and M.J. Schervish), 1987, *Proceedings of the Statistical Computing Section, American Statistical Association*, (to appear). (This was previously published in *The American Statistician*).
- Eddy, W.F., Invited Discussion of "Dynamic Graphics for Data Analysis" by Richard A. Becker, William S. Cleveland, and Allan R. Wilks, 1987, *Statistical Science* (in press).
- Eddy, W.F., Invited Discussion of "Graphical Perception: The Visual Decoding of Quantitative Information on Graphical Displays of Data" by William S. Cleveland and Robert McGill, 1987, *Journal of the Royal Statistical Society* (in press).
- Fienberg, S.E., Book review of *Religious Assortive Marriage in the United States*, by R.A. Johnson, in *J. Amer. Statist. Assoc.*, **82** (1987), 353.
- Schervish, M.J., Bayesian modeling and forecasting in autoregressive models with exogenous variables (with R. Tsay), 1987, *Bayesian Analysis of Time Series and Dynamic Models*, (to appear).

## **Invited Presentations at Topical or Scientific/Technical Society Conferences**

1984:

- Eddy presented an invited seminar on July 6, 1984 to the Department of Mathematics, University of Heidelberg, Heidelberg, West Germany.
- Eddy served as an invited discussant on August 15, 1984 at the annual meeting of the American Statistical Association in Philadelphia, PA.
- Fienberg served as an invited discussant on August 15, 1984 at the annual meeting of the American Statistical Association in Philadelphia, PA.
- Fienberg lectured on "Assessing Probability Forecasters," at the ASTIM (Actuarial) Conference in Berkeley, CA during October, 1984.
- Eddy presented an invited seminar on October 3, 1984 to the Department of Statistics, University of Michigan, Ann Arbor, MI.
- Eddy presented an invited seminar on October 11, 1984 to the Department of Mathematics, Indiana University of Pennsylvania, Indiana, PA.
- Eddy presented an invited seminar on October 22, 1984 to the Department of Mathematics, Tufts University, Medford, MA.
- Eddy served as an invited discussant on October 23, 1984 at the ASA-IASC-SIAM conference on Frontiers in Computational Statistics in Boston, MA.

1985:

- Eddy presented an invited paper on March 18, 1985 at Computer Science and Statistics: Seventeenth Annual Symposium on the Interface in Lexington, KY.
- Eddy presented an invited seminar on April 8, 1985 at the Statistics Center, Massachusetts Institute of Technology, Cambridge, MA.
- Eddy presented an invited seminar on April 10, 1985 at the Statistics Center, Massachusetts Institute of Technology, Cambridge, MA.
- Fienberg served as an invited discussant of papers at the symposium on "Scientific Issues in the 1990 Census," Annual Meeting of AAAS, Los Angeles, May 1985.
- Eddy served as an invited discussant on May 22, 1985 at the N.B.S. Chemometrics Conference in Gaithersburg, MD.
- Eddy presented an invited paper on June 19, 1985 to the SREB Research Conference in Statistics at Boone, NC.
- Eddy presented an invited seminar on July 15, 1985 at Bell Communications Research in Morristown, NJ.
- Eddy served as an invited discussant on August 8, 1985 at the annual meeting of the American Statistical Association in Las Vegas, NV.
- Eddy presented an invited seminar on November 13, 1985 to the Department of Statistics, University of Kentucky, Lexington, KY.

- Fienberg presented an invited lecture entitled "The Categorical Imperative" to the International Meeting on the Foundations of Statistics and its Applications in Tel Aviv, Israel during December, 1985.
- Fienberg served as an invited discussant of a paper by J. Durbin, "Is a philosophical consensus for statistics attainable," at the International Meeting on the Foundations of Statistics and its Applications in Tel Aviv, Israel during December, 1985.
- Fienberg presented an invited seminar to the Department of Statistics at The Technion in Haifa, Israel during December, 1985.

1986:

Eddy gave an invited presentation on March 20, 1986 at Computer Science and Statistics: Eighteenth Annual Symposium on the Interface, Ft. Collins, CO.

Fienberg gave an invited talk entitled "Adjusting the Census: Methodology for going beyond the count," on March 26, 1986 at the Census Annual Research Conference in Reston, VA.

Eddy gave an invited presentation entitled "Uncertainty in Expert Systems" on April 9, 1986 at celebration of The 60th Birthday of the Washington Statistical Society at George Washington University in Washington, D.C.

Fienberg gave an invited seminar to the Department of Mathematics, Statistics, and Computer Science at Dalhousie University in Halifax, Canada on April 1, 1986, entitled "Statistics as a language and a guide to science and policy."

Fienberg gave an invited talk entitled "The relevance of Bayesian inference for the presentation of statistical evidence and for legal decisionmaking," at the Symposium on Probability and Inference in the Law of Evidence, Boston University, April 4, 1986.

Fienberg led discussion of a paper by L.J. Cohen at the Symposium on Probability and Inference in the Law of Evidence, Boston University, April 5, 1986.

Eddy and Fienberg presented testimony on "Census Bureau's Plans for 1990 Decennial Census," on May 1, 1986 to the Subcommittee on Census and Population of the Committee on Post Office and Civil Service, U.S. House of Representatives.

Eddy presented an invited paper on May 19, 1986 to the Bayesian Computing Workshop at Ohio State University in Columbus, OH.

Fienberg presented testimony on "Adjustment Methodology and Timing of Decisions for the 1990 Census," on July 23, 1986 to the Subcommittee on Census and Population of the Committee on Post Office and Civil Service, U.S. House of Representatives.

Fienberg was an invited discussant of the General Methodology Lecture, "Analysis of Categorical Data" by P. McCullagh, Joint Statistical Meetings, August, 1986.

Eddy presented an invited paper to the International Workshop on Bayesian Analysis on September 19, 1986 in Stresa, Italy.

Fienberg delivered an invited talk entitled, "Bayesian Inference and the Evaluation of Statistical Evidence for Legal Decisionmaking," to the NBER NSF Seminar on Bayesian Inference in Econometrics at Riverside, CA, on October 24, 1986.

1987:

- Eddy gave a special invited keynote address to the First Winter meeting of the American Statistical Association on January 10, 1987 in Orlando, Fl.
- Eddy gave an invited seminar at Los Alamos National Laboratory on January 21, 1987 in Los Alamos, NM.
- Eddy gave a special invited lecture at the Middle East Technical University in Ankara, Turkey on March 27, 1987.
- Eddy gave the inaugural address at the First International Conference on Statistical Computing on March 30, 1987 in Cesme, Izmir, Turkey.
- Eddy gave an invited seminar at the Department of Statistics and Computer Information Systems at Baruch College of CUNY on May 5, 1987.
- Fienberg was a special invited speaker at the Sino-American Statistical Meeting in Beijing, China, September, 1987.

#### **Contributed Presentation at Topical or Scientific/Technical Society Conferences**

- Eddy presented a contributed paper on November 20, 1985 to the Second SIAM Conference on Parallel Processing for Scientific Computing in Norfolk, VA.

#### **Honors/Awards/Prizes**

- Eddy, W.F., Visiting Professor, July 1984 - August 1984 - University of Heidelberg, Germany.
  - Fienberg was awarded Guggenheim Foundation Fellowship, July 1, 1984 - June 30, 1985.
  - Fienberg was appointed Fellow, Center for Advanced Study in the Behavioral Sciences, July 1, 1984 - June 30, 1985.
  - Eddy was appointed visiting professor of statistics at Massachusetts Institute of Technology during March, 1985.
  - Fienberg was elected Vice-President of the American Statistical Association, 1986-1988.
  - Fienberg was named to the Maurice Falk Professorship, Carnegie Mellon University, at a special dinner held in December, 1986.
  - Fienberg was appointed to Editorial Board of the Statistician, 1986-1988.
  - Fienberg was named Dean, College of Humanities and Social Sciences, Carnegie Mellon University, March, 1987.
- Eddy was appointed a Resident Visitor to Bell Communications Research, Morristown, NJ during the spring of 1987.
- Eddy was elected a Fellow of the American Association for the Advancement of Science in 1987.
- Eddy was appointed Vice-Chair of the American Statistical Association Committee on Energy Statistics.
- Eddy was appointed the North American Regional Editor for the Statistical Software Newsletter of the International Association for Statistical Computing.

- Eddy served as an Associate Editor for SIAM Review from 1984 to 1987.

### Technical Reports

- Eddy, W.F. Models of Inexact Reasoning. Technical Report No. 351 (with P.K. Black), May 1985.
- Eddy, W.F. Inexact Reasoning with Belief Functions. Technical Report No. 369 (with P.A. Zalevsky), June 1986.
- Eddy, W.F. The Implementation of Belief Functions in a Rule-based System. Technical Report No. 371 (with P.K. Black), June 1986.
- Eddy, W.F. Maximum Self-Decomposable Distributions and Their Domains of Attraction, (with E. Sungur), June 1987.

### Persons Supported

#### *Faculty*

William F. Eddy  
Stephen E. Fienberg  
Gail Gong  
Albyn Jones  
Mark J. Schervish

#### *Graduate Students*

Anthony A. Billings  
Dean Follmann  
Lionel A. Galway  
Richard Holubkov

#### *Undergraduate Student*

Joreen Sicks

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