ALEXANDER PHILIP DAWID

Emeritus Professor of Statistics
University of Cambridge

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EDUCATION

1967–69	University of London (Imperial College; University College)
1963–67	Cambridge University (Trinity Hall; Darwin College)
1956–63	City of London School

QUALIFICATIONS

1982	ScD (Cantab.)
1970	MA (Cantab.)
1967	Diploma in Mathematical Statistics (Cantab.: Distinction)
1966	BA (Cantab.): Mathematics (Second Class Honours)
1963	A-levels: Mathematics and Advanced Mathematics (Double Distinction), Physics (Distinction)
	State Scholarship

HONOURS AND AWARDS

2018	Fellow of the Royal Society
2016	Fellow of the International Society for Bayesian Analysis
2015	Honorary Lifetime Member, International Society for Bayesian Analysis
2013	Network Scholar of The MacArthur Foundation Research Network on Law and Neuroscience
2002	DeGroot Prize for a Published Book in Statistical Science
2001	Royal Statistical Society: Guy Medal in Silver
1978	Royal Statistical Society: Guy Medal in Bronze
1977	G. W. Snedecor Award for Best Publication in Biometry

EMPLOYMENT ETC.

2013–	Emeritus Professor of Statistics, Cambridge University
2013–	Emeritus Fellow, Darwin College Cambridge
2007–13	Professor of Statistics and Director of the Cambridge Statistics Initiative, Cambridge University
2011–13	Director of Studies in Mathematics, Darwin College Cambridge
2007–13	Professorial Fellow, Darwin College Cambridge
1989–2007	Pearson Professor of Statistics, University College London
1983–93	Head, Department of Statistical Science, University College London
1982–89	Professor of Probability and Statistics, University College London
1981–82	Reader in Probability and Statistics, University College London
1978–81	Professor of Statistics, Head of Statistics Section, and Director of the Statistical Laboratory, Department of Mathematics, The City University, London
1969–78	Lecturer in Statistics, University College London

VISITING POSITIONS ETC.

2016	Visiting Scientist, University of Cagliari
2013–16	Visiting Fellow, Department of Mathematical Sciences, Durham University
2013–15	Visiting Fellow, Department of Criminology, Cambridge University
2010	Visiting Professor, University of Cagliari
2009–18	Honorary Professor, University of Hong Kong
2007–22	Honorary Professor, University College London
2001–02	Affiliate Professor, Gatsby Computational Neuroscience Unit, University College London
1982	Visiting Research Fellow, University of Wisconsin at Madison
1974–75	Visiting Lecturer in Statistics, University of British Columbia

RESEARCH GRANTS

UK Research Councils

2009–12	Genetic variation, disease prediction and causation	∼£250,000
2007–12	Cambridge Statistics Initiative	∼£2.6M
2006–09	Geometrical methods for statistical inference and decision	∼£250,000
2006–09	World of uncertainty (co-investigator)	∼£260,000
2006–09	Simplicity, complexity and modelling (co-investigator)	∼£250,000
1992–94	An abstract approach to expert systems	∼£100,000
1989–91	Bayesian analysis in expert systems	∼£30,000
1988–90	Probabilistic modelling for expert systems	∼£90,000

Visiting Fellowships

1985	M. J. Schervish	∼£6,000
1984	M. H. DeGroot	∼£2,000
1983–4	J. M. Dickey	∼£6,000

PROFESSIONAL SOCIETIES

Royal Society

2019–22	Member, Sectional Committee 1 (Mathematics)
2018	Elected Fellow

Royal Statistical Society

2015–19	Statistics and Law Section Committee
2013–15	Statistics and Law Working Group
1993	Chartered Statistician
1992	Joint Editor, *Journal, Series B*
1987–89	Chairman, Research Section
1981–82	Vice-President
1978–80	Honorary Secretary, Research Section
1975–78	Associate Editor, *Journal, Series B*

Read Papers

1990	Fisherian inference in likelihood and prequential frames of reference
1987	Symmetry models and hypotheses for structured data layouts
1978	Conditional independence in statistical theory
1973	Marginalization paradoxes in Bayesian and structural inference (with M. Stone and J. V. Zidek)

Institute of Mathematical Statistics

1979	Elected Fellow
1977–82	Associate Editor, *Annals of Statistics*

International Statistical Institute

1978	Elected Member

Biometrika Trust

1996–2023	Trustee
1992–96	Editor, *Biometrika*
1984–92	Trustee

International Society for Bayesian Analysis

2005–9	Editor, *Bayesian Analysis*
2000	President
1998	Director

FURTHER PROFESSIONAL ACTIVITIES

2020–21	RAMP (Rapid Assistance in Modelling the Pandemic) Steering Committee
2020–	Associate Editor, *Statistical Science*
2015–19	Technical Advisory Committee Center for Statistics and Applications in Forensic Evidence, Iowa State University
2012–18	Group to Individual Committee, MacArthur Foundation Law and Neuroscience Network, USA
2012	ASA Committee on Establishment of an International Prize in Statistics
2011–	Editorial Board, *Journal of Causal Inference*
2010	External Assessor, APRC Review of the Department of Statistics, London School of Economics
2009	Institute for Mathematical Sciences Advisory Board, Imperial College
2008–12	Board of Managers, Kuwait Foundation Fund
2007	President's Advisory Board, Carnegie Mellon University Machine Learning Department
2006–8	Academy of Medical Sciences Working Party on Non-Experimental Methods
1989	External Assessor, Appointment Committee for Chair of Statistics, University of Durham
1988–91	UK Medicines Commission
1987–2020	Trustee, Neuroendocrinology Charitable Trust
1987–89	Chairman, Board of Studies in Statistics, University of London
1983–91	Editorial Board, Oxford University Press Statistical Science Series
1982–85	SERC Statistics Panel
1978–91	Royal College of Physicians Computer Committee

External Examining

1998–2001	University of Kent
1995–97	Chief External Examiner for Combined Sciences, Hong Kong Baptist University
1992–94	University of Ulster
1986–90	Imperial College of Science, Technology and Medicine
1986–89	University College of Swansea
1982–85	University of Hong Kong
1980–83	University of Surrey

Conference Organisation

2013	Organiser, Special Topic Session on Probability Forecasting, 59th World Statistics Conference, Hong Kong
2011	Joint Organiser, Darwin College Lecture Series on "Beauty", Cambridge
2010	Joint Organiser, Third Workshop on Game-Theoretic Probability and Related Topics, Royal Holloway University of London
2009	Joint Organiser, Machine Learning Summer School, Cambridge
2009–10	Co-Convenor, Mellon Sawyer Seminar on Modelling Futures: Understanding Risk and Uncertainty, Cambridge
2009	Joint Organiser, Molpage Training Programme on Causal Inference: State of the Art, Cambridge
2009	Joint Organiser, Communicating Complex Statistical Evidence, Cambridge
2008	Joint Organiser, LMS Symposium on Mathematical Aspects of Graphical Models, Durham
2008	Organiser, Cambridge Statistics Initiative 1-Day Meeting, Cambridge
2007	Programme Committee Chair, British Academy Conference on Enquiry, Evidence and Facts: An Interdisciplinary Conference
2005	Programme Committee, 10th International Workshop on Artificial Intelligence and Statistics, Barbados
2004	Scientific Programme Committee, 3rd Winter Workshop on Statistics and Computer Science, Ein-Gedi, Israel
2001	Organizer, DNA Workshop Meeting, Lewes
2001	Programme Committee, 8th International Workshop on Artificial Intelligence and Statistics, Key West, Florida
2000	Joint Organiser and Head of UK Delegation, International Conference on Foundations of Statistical Inference, Jerusalem
2000	Joint Conference President, 6th World Meeting of the International Society for Bayesian Analysis, Crete
2000	Joint Organiser, HSSS Research Kitchen on Probabilistic Expert Systems for Genetic Analysis, San Vigilio, Italy
1999	Scientific Programme Committee and Seminar Organiser, Research Programme on Causal Interpretation and Identification of Conditional Independence Structures, Fields Institute, Toronto
1998	Joint Organiser, HSSS Workshop on Structural Learning in Graphical Models, Tirano, Italy
1991, 1994, 1998, 2002, 2006, 2010	Organising Committee, Valencia International Meetings on Bayesian Statistics
1986	Joint Academic Organiser, RSS/SERC Research Workshop on Asymptotic Statistical Inference, Edinburgh
1982, 1986	Joint Technical Convenor: Institute of Statisticians Conferences on Practical Bayesian Statistics, Cambridge

In addition, I have served on numerous University and Professional committees.

INVITED PRESENTATIONS, ETC.

2023	Keynote Lecture, Symposium on Causal Inference, London
2022	Artificial Intelligence, Causality and Personalized Medicine, Hannover (online)

2021	KDD Workshop on Bayesian Causal Inference for Real World Interactive Systems (online)
2019	Statistical Analysis of Multi-Outcome Data, Manchester
2019	Keynote Lecture, Bayesian, Fiducial, and Frequentist Conference, Duke University
2019	European Causal Inference Meeting, Bremen
2018	Keynote Lecture, MRC Biostatistics Unit Causal Inference Symposium, Cambridge
2018	de Finetti Lecture, International Society for Bayesian Analysis, Edinburgh
2018	Workshop in Honour of Maria Carla Galavotti, Bertinoro, Italy
2017	Special Invited Paper, Computational and Methodological Statistics, London
2017	Data, Databases and Expert Knowledge in Forensic Inference, Carnegie-Mellon University
2017	UK Causal Inference Meeting, Colchester
2016	Lecture course, University of Cagliari
2016	Programme on Probability and Statistics in Forensic Science, Isaac Newton Institute, Cambridge
2016	Paper Highlights from *Bayesian Analysis* Session, Joint Statisticsl Meetings, Chicago
2016	Paper Highlights from *Statistics and Public Policy* Session, Joint Statisticsl Meetings, Chicago
2016	International Society for Bayesian Analysis, Sardinia
2016	Keynote Speaker, Société Française de Statistique, Montpellier
2015	Center for Statistics and Applications in Forensic Evidence Kickoff Event, Ames, Iowa
2015	RSS Statistics and the Law Section Meeting on Epidemiological Evidence and Tort Litigation, London
2015	International Workshop on Causality, Counterfactuals, and Legal Responsibility, Sassari
2015	Fifth Conference of the European Philosophy of Science Association, Düsseldorf
2015	Lindley Memorial Session, Joint Statistical Meetings, Seattle
2015	Greek Stochastics, Crete
2015	Danish Society of Theoretical Statistics, Copenhagen
2015	Keynote Speaker, UK Causal Inference Meeting, Bristol
2015	Fifth Workshop on Game-Theoretic Probability and Related Topics, Guanajuato, Mexico
2014	Keynote Speaker, 9th International Conference on Forensic Inference and Statistics, Leiden
2014	47th Scientific Meeting of the Italian Statistical Society, Cagliari
2014	Keynote Speaker, Korean Statistical Society Spring Meeting, Daejeon
2014	KNAW Colloquium on Dependence Logic, Amsterdam
2013	12th European Conference on Symbolic and Quantitative Approaches to Reasoning with Uncertainty, Utrecht
2013	High-Dimensional Inference with Applications, Kent
2013	RSS Bayes 250 Meeting, London
2013	Methodological Issues in the Special Sciences, Bertinoro, Italy
2013	Recent Advances in Statistical Inference, Padua
2013	Seminar on Dependence Logic: Theory and Applications, Dagstuhl, Germany
2013	Max Planck Intelligent Systems Colloquium, Tübingen, Germany
2012	Probabilistic Expert Systems for Forensic Genetics, Rome
2012	Symposium on Conditional and Direct Causal Effects, Jena
2012	Lecture course, Università Roma Tre
2012	The Hidden Side of DNA Profiles, Rome
2012	Causal Inference and Dynamic Decisions in Longitudinal Studies, Bristol
2011	30th Fisher Memorial Lecture, Cambridge
2011	8th International Conference on Forensic Inference and Statistics, Seattle
2011	Guest Lecturer, Vienna International Summer University
2011	Hierarchical Models and Markov Chain Monte Carlo, Crete
2011	Causal Inference in the Health Sciences, Bologna
2011	Workshop on Geometric and Algebraic Statistics 3, Warwick
2010	Information Geometry and its Applications III, Leipzig
2010	Third Workshop on Game-Theoretic Probability and Related Topics, Royal Holloway University of London
2010	Young Researchers in Mathematics 2010, Cambridge
2010	Saw Swee Hock Lecture in Statistics, University of Hong Kong
2009	Perspectives on Causation, School of Law, University of Aberdeen
2009	Atlantic Causal Modeling Conference, University of Pennsylvania
2009	Causal Inference: State-of-the-Art, Cambridge
2009	Mixing Econometrics and Epidemiology, Imperial College London
2009	Communicating Complex Statistical Evidence, Cambridge
2008	Causality: Objectives and Assessment. Neural Information Processing Systems Workshop, Whistler
2008	Tutorial, Neural Information Processing Systems Conference, Vancouver
2008	Gruppo Ematologi Forensi Italiani, Padova
2008	LMS Symposium on Mathematical Aspects of Graphical Models, Durham
2008	The Rôle and Evaluation of Evidence in Economic Analysis, Bologna
2008	Franklin Institute Awards Symposium, Philadelphia
2008	Geometric Aspects of Conditional Independence and Information, Leipzig
2007	British Academy Conference on Enquiry, Evidence and Facts: An Interdisciplinary Conference
2007	Reassessing the Paradigms of Statistical Model Building, Oberwolfach, Germany
2007	Academy of Experts, London
2007	Evidence in the Human Sciences, Bologna
2007	Confirmation, Induction and Science, London School of Economics
2007	Seymour Geisser Memorial Lecture, University of Minnesota

2007	Graphic and Visual Representations of Evidence and Inference in Legal Settings, Cardozo Law School, New York
2006	de Finetti Centenary Meeting, Bologna
2006	Pluralism and Causality in the Sciences, London School of Economics
2006	Medical Thinking: What Do We Know? CRUK, London
2006	40th Anniversary Celebrations, Department of Statistics, Glasgow
2006	Causality and Probability in the Sciences, University of Kent
2006	Teaching Evidence and Fact Analysis, Institute of Advanced Legal Studies, London
2006	Causation, Probability and Decision, Sydney University
2006	Bayesian Reasoning Workshop, Monash University
2006	Distinguished Lecture in Computer Science, Queen Mary, University of London
2005	Second International Conference on Information Geometry, Tokyo
2005	21st Congress of the International Society for Forensic Genetics, Azores
2005	Second Workshop on Combining Probability and Logic, London School of Economics
2005	British Society for Philosophy of Science Annual Conference, Manchester
2005	International Conference on Statistics, Hong Kong
2005	Human Identification E-Symposium 2005
2005	Sixth International Conference on Forensic Statistics, Tempe, Arizona
2004	Royal Statistical Society Conference, Manchester
2004	International Summer School on 'Causality, Uncertainty and Ignorance', Konstanz, Germany
2004	PASCAL Workshop on Learning-Theoretic and Bayesian Inductive Principles, London
2004	Information Processing and Management of Uncertainty, Perugia
2004	19th Annual Darwin College Lecture Series, Cambridge
2003	GSS Assistant Statistician & Statistical Officer Annual Conference, Reading
2003	Workshop on Paradigms of Model Building, Dortmund
2003	MIR@C Workshop on Bayesian Networks and Micro-Array Analysis, Warwick
2003	CISHE Colloquium on Transitions, University College London
2003	54th Session of the International Statistical Institute, Berlin (Invited Paper Meeting Organiser)
2003	Workshop on Complexity and Inference, Rutgers University
2003	Workshop on Statistical Learning in Classification and Model Selection, Eindhoven
2002	Fifth International Conference on Forensic Statistics, Venice
2002	AMS Summer Research Conference on Emerging Issues in Longitudinal Data Analysis, Mount Holyoke College, Massachusetts
2002	Conference on Causality: Metaphysics and Methods, London School of Economics
2001	Workshop on Recent Developments and Applications in the Statistical Analysis of Discrete Structures, Munich
2001	Conference on Statistical Models and Computationally Intensive Methods for Estimation and Prediction, Bressanone, Italy
2001	Conference on Causality and Statistics, Snowbird, Utah
2001	Rietz Lecturer, IMS Annual Meeting, Atlanta, Georgia
2001	Seminar on Inference Principles and Model Selection, Dagstuhl, Germany
2001	ISBA Regional Meeting, Laguna Beach
2001	Symposium on Bayes's Theorem, The British Academy, London
2001	HSSS Workshop on Structural Stochastic Systems for Individual Behaviours, Louvain-la-Neuve, Belgium (Discussant)
2001	Eighth International Workshop on Artificial Intelligence and Statistics, Key West, Florida
2000	International Conference on Foundations of Statistical Inference, Jerusalem
2000	Seminar in Honour of Abner Shimony, Bologna
2000	DINA Research Kitchen on Probabilistic Expert Systems for Genetic Analysis, Skagen, Denmark
2000	HSSS Final Workshop, Luminy, France
2000	21st Meeting of the International Society for Clinical Biostatistics, Trento, Italy (Discussant)
2000	AMS Summer Research Conference on Bayes, Frequentist and Likelihood Inference: A Synthesis, Mount Holyoke College, Massachusetts
2000	Fourth Conference on Logic and the Foundations of the Theory of Games and Decisions, Turin
2000	Sixth World Meeting of the International Society for Bayesian Analysis, Crete
2000	International Conference on Philosophical Aspects of Bayesianism, King's College London
2000	Workshop on Forecast Validation and Risk Assessment, Humboldt University, Berlin
2000	HSSS Research Kitchen on Probabilistic Expert Systems for Genetic Analysis, San Vigilio, Italy
1999	Fourth International Conference on Forensic Statistics, North Carolina State University
1999	Research Seminars on 'Conditional Independence Structures and Graphical Models' and 'Causal Interpretation of Graphical Models', Research Programme on Causal Interpretation and Identification of Conditional Independence Structures, Fields Institute, Toronto
1999	Second European Conference on Highly Structured Stochastic Systems, Pavia
1999	52nd Session of the International Statistical Institute, Helsinki (Invited Paper Meeting Organiser)
1999	Workshop on On-Line Decision Making, Rutgers University
1999	International Workshop on Objective Bayesian Methodology, Valencia
1999	Uncertainty 99 (Seventh International Workshop on Artificial Intelligence and Statistics), Fort Lauderdale, Florida
1998	HSSS Workshop on Structural Learning in Graphical Models, Tirano, Italy
1998	Special Invited Speaker, Joint UAI/ICML/COLT Meetings, Madison, Wisconsin
1998	Conference on Automated Learning and Discovery, Pittsburgh

1998	Sixth Valencia International Meeting on Bayesian Statistics
1997	Programme on Neural Networks and Machine Learning, Isaac Newton Institute, Cambridge
1997	AMS-IMS-SIAM Summer Research Conference on Graphical Markov Models, Influence Diagrams, and Bayesian Belief Networks, Seattle
1997	Joint Statistical Meetings (ASA), Anaheim (Session organiser)
1997	International Society for Bayesian Analysis, Istanbul
1997	International Symposium on Contemporary Multivariate Analysis and its Applications, Hong Kong (Session organiser and speaker)
1997	Tutorial, Sixth International Workshop on Artificial Intelligence and Statistics, Fort Lauderdale, Florida
1996	NATO Advanced Study Institute on Learning in Graphical Models, Erice, Sicily
1996	Fourth World Congress of the Bernoulli Society, Vienna
1996	Third International Conference on Forensic Statistics, Edinburgh
1995	Third Brazilian Bayesian Statistics Meeting, Ouro Preto
1995	Closing Address, Sixth Latin American Congress on Probability and Statistics, Viña del Mar, Chile
1995	Algebraic and Combinatorial Methods in Multivariate Analysis, Oberwolfach, Germany
1995	Research Seminar on Probability and Causality, Aalborg, Denmark
1995	Second International Workshop on Bayesian Robustness, Rimini, Italy
1995	Mahalanobis Memorial Lectures, Indian Statistical Institute: Delhi, Bangalore, Calcutta
1994	Second European Science Foundation Workshop on Highly Structured Stochastic Systems, Wiesbaden, Germany
1994	First European Science Foundation Workshop on Highly Structured Stochastic Systems, Cortona, Italy
1994	Drug Information Association 5th European Workshop on Statistical Methodology in Clinical Research, Edinburgh
1993	International Workshop on Hierarchical Modelling, Rio de Janeiro
1993	Computer Vision Programme, Isaac Newton Institute, Cambridge
1993	Second DeGroot Memorial Lecture, Carnegie-Mellon University
1993	49th Session of the International Statistical Institute, Florence
1993	First Multinational Riverboat Conference on Bayesian Econometrics and Statistics, Basel–Amsterdam
1992	International Symposium on Social Gerontology, Jaen, Spain
1992	Royal Statistical Society Conference, Sheffield
1992	Institute of Statisticians Conference on Practical Bayesian Statistics, Nottingham
1992	Fifth Purdue International Symposium on Statistical Decision Theory and Related Topics
1992	International Symposium on Multivariate Analysis and its Applications, Hong Kong
1991	Conference on Recent Developments of Exchangeable Random Processes and their Statistical Applications, Cortona, Italy
1991	Fourth Valencia International Meeting on Bayesian Statistics
1990	Lecture course, University of Perugia, Italy
1990	Royal Statistical Society Fisher Centenary Meeting, London
1989	18th National Statistics Meeting, Santiago de Compostela, Spain
1989	RSS/SERC Research Workshop on Expert Systems and Statistics, Edinburgh
1989	Lecture Course, Bocconi University, Milan
1988	Joint Statistical Meetings, New Orleans
1988	14th George Zyskind Memorial Lecture, Iowa State University
1987	Third Valencia International Meeting on Bayesian Statistics
1986	Second Catalan International Symposium on Statistics, Barcelona
1986	Institute of Statisticians Conference on Practical Bayesian Statistics, Cambridge
1986	RSS/SERC Research Workshop on Asymptotic Statistical Inference, Edinburgh
1985	Lecture course, Department of Biostatistics, University of Valencia
1984	20th Gregynog Statistical Conference
1984	Royal Statistical Society 150th Anniversary Conference, London
1984	Israel Statistical Association Conference on Foundations of Statistical Inference, Tel Aviv
1983	British Society for the Philosophy of Science Annual Conference, Brighton
1983	Special Invited Paper, Institute of Mathematical Statistics Meeting, Nashville
1982	European Meeting of Statisticians, Palermo
1982	Royal Statistical Society Conference, York
1982	Lecture Course, University of London Postgraduate Statistics Series
1981	Conference on Exchangeability in Probability and Statistics, Rome
1980	Conference on Medical Statistics, Rome
1979	International Meeting on Bayesian Statistics, Valencia
1978	Dutch Statistical Meeting, Lunteren
1978	Institute of Mathematical Statistics Conference, San Diego
1977	Lecture course, Department of Statistics, Carnegie-Mellon University
1977	Lecture Course, Istituto per le Applicazione del Calcolo, Rome
1976	European Meeting of Statisticians, Grenoble
1976	First European Conference on the Foundations and Applications of Bayesian Methods, Fontainebleau
1974	Research Conference, Department of Theoretical Statistics, Aarhus University

Additionally I have given numerous invited research seminars at Universities in the UK and abroad, and have proposed or seconded the vote of thanks on fifteen Royal Statistical Society discussion papers.

TEACHING

Postgraduate Courses

Advanced Statistics and Inference   Advanced Statistics
Practical Statistics   Comparative Statistical Methods
Probabilistic Expert Systems and   Applied Bayesian Methods
   Image Analysis   Communication Workshop
Time Series   Monte Carlo Inference
Causal Inference

Undergraduate Courses

Elementary Statistics   Stochastic Processes
Statistical Prediction Analysis   Probability
Frequency Data   Multivariate Analysis
Bayesian Probability and Inference   Decision Analysis
Linear Methods and Analysis of Variance   Computational Techniques for Statistics
Stochastic Systems   Statistical Inference
Stochastic Methods in Finance   Principles of Statistics

Ancillary Courses

Probability for Mathematicians   Statistics for Medical Students
Statistics for Systems and Management   Evidence and Proof (Ll.M. Students)
Graduate School Foundation Course

External Courses

Industrial Statistics   Lucas Institute for Engineering Production
Bayesian Statistics for Science, Engineer- George Washington University
   ing, Medicine and Management
Statistical Methods in Reliability   George Washington University
Fundamentals of Statistical Causality   RSS/EPSRC Graduate Training Programme
Fundamentals of Statistical Causality   Dipartimento di Economia, Università Roma Tre
Causality   Machine Learning Summer School, Cambridge

MAJOR CONSULTING ACTIVITIES

Auto-Roulette
Performance Analysis of Electronic Gaming Machines
Department of Health/British Dental Association
Measurement of Dentists' Workload (Report deposited in House of Commons Library)
W. S. Atkins Management Consultants/Anglian Water/South-West Water
Verification of Statistical Methodology and Software for Water Company Asset Management Plans
Glaxo Group Research Limited/Fastmalt Limited
An Expert System for Assessing Adverse Drug Reactions
Various Solicitors
Adviser/expert witness on the interpretation of statistical evidence — especially DNA profile evidence
Railtrack PLC
Expert Knowledge Elicitation

RESEARCH INTERESTS AND ACHIEVEMENTS

My research has been motivated by the desire to understand and explore the connexions between logical and philosophical principles of inference, mathematical structures, and data-analysis. Much of my work is a critical examination of the logical **Foundations of Statistics**, both from a general standpoint and in respect of particular schools of thought — especially Bayesian, but also Frequentist, Likelihood, Structural and Fiducial. Early work that uncovered a **Marginalization Paradox** in improper Bayesian inference stimulated continuing debate. I have a particular interest in **Bayesian Decision Theory**, and developed and applied general decision-theoretic ideas to clarify the theory of **Optimal Experimental Design**. Other Bayesian research interests have included: **Coherent Combination of Expert Opinions**; **Matrix Distribution Theory and Bayesian Multivariate Analysis** (where work with BiQi Fang discovered undesirable properties of conjugate prior distributions in problems with many variables, and suggested some better-behaved alternatives); **Model Uncertainty**; **Maximum Entropy** and **Robust Bayes Analysis** (which, in work with Peter Grünwald, were shown to be two sides of the same coin); and **Bayesian Inference for Graphical Models**.

In 1979 I introduced a general axiomatic theory and associated notation for **Conditional Independence**, which has become so mainstream as to be largely taken for granted. A particularly useful aspect is the possibility of incorporating non-stochastic variables, such as statistical parameters or external interventions. I have continued to develop and apply this topic throughout my career. As well as being a valuable tool for formulating and solving a great variety of conceptual and technical problems, conditional independence supplies a unifying thread drawing together many seemingly unrelated concepts of statistical inference, such as sufficiency and parameter identification. I later developed a novel algebraic framework, the **Separoid**, which supports the application of

these ideas to a wide range of other irrelevance concepts of independent interest.

Over 45 years ago I made contributions to a novel approach to statistical inference from the viewpoint of differential geometry, showing the relevance and importance of the exponential and mixture connexions, and laying foundations for the detailed development of **Information Geometry** by Amari and others. Much later I re-engaged with this area, extending it to a more general **Decision Geometry**. With Steffen Lauritzen and Matthew Parry I developed a complete characterisation of **Local Proper Scoring Rules**, which encourage honesty when assessing probability distributions while depending only on the probabilistic assessment made in the neighborhood of the realised outcome.

A major research effort over many years was devoted to **Probabilistic Expert Systems**, now more popularly known as **Bayesian Networks**: a multi-faceted topic which applies graph-theoretic representations to analyse, structure and manipulate complex multivariate distributions. My theory of Conditional Independence plays a crucial rôle in this. Together with Steffen Lauritzen, David Spiegelhalter and Robert Cowell, I developed fundamental theory, algorithms for computer implementation, and application to real problems. This work has been implemented in software systems such as Hugin, and was described in a joint monograph *Probabilistic Networks and Expert Systems* published by Springer in 1999, which was awarded the first DeGroot Prize for a Published Book in Statistical Science.

An important philosophical attitude underpinning almost all my work is a 'positivist' emphasis on observables and on the falsifiability of inferences. In particular this has guided my approach to the interpretation, assessment and validation of probability statements. I introduced the **Calibration Criterion** of validity for probability forecasts, and developed this into a novel philosophical account of **Objective Probability** and **Individual Risk**. The same attitude provided the impetus for my introduction of **Prequential Analysis**, a general approach to problems of statistical inference and data-analysis that takes seriously the problem of formulating and criticising probabilistic forecasts. On the theoretical front it enjoys has many pleasing properties, motivating broad extensions of classical ideas such as estimator efficiency and consistent model selection. Practically, it supplies a more generally applicable and interpretable alternative to cross-validation. Prequential Analysis has been successfully applied to the monitoring and improvement of the predictive performance of Bayesian Networks. It has close links with Bayesian Inference, with the theory of Stochastic Complexity, with Algorithmic Complexity Theory, and with Computational Learning Theory (COLT). With Vladimir Vovk I developed a new mathematical theory of **Prequential Probability**, based on game-theoretic rather than measure-theoretic foundations. This has formed a basis for Vovk's influential book (with Glenn Shafer) *Game-Theoretic Foundations for Probability and Finance*.

Another fundamental research theme was **Symmetry Modelling**, which, extending de Finetti's ideas of exchangeability, uses symmetry judgements and group representation theory to guide the construction, interpretation and analysis of statistical models. For simple balanced experimental layouts the symmetry viewpoint has provided new insights and methods of data-analysis, while it has led to new forms, analyses and understandings of the 'mixed model' of the Analysis of Variance. A complete algebraic theory was developed for general poset block structures. Because of competing priorities much of this work remains unpublished, but it was featured in my 2011 Fisher Memorial Lecture.

In recent years I have been especially interested in developing new formulations and techniques for **Statistical Causal Inference**, a topic of great current interest. My approach, built upon my theory of Conditional Independence and with links to Bayesian Decision Theory, Symmetry Modelling and Bayesian Networks, is more firmly based philosophically, and more suitable for applications, than other current mainstream conceptions. In particular, I have shown how sensible causal inferences can be justified without recourse to counterfactual reasoning. This straightforward approach clarifies and simplifies the many problems of causal inference, as exemplified by applications to confounding, direct and indirect causal effects, and the effects of dynamic interventions.

I have acted as expert advisor or witness in a number of legal cases, notably that of Sally Clark who was accused of murdering her two baby sons, and several others involving DNA profiling and fibre transfer. This led me to a thorough theoretical examination of the use of Probability and Statistics in **Legal Reasoning** and **Forensic Identification**, as well as to some related study of genetic population structure. I led an international research group that developed probabilistic expert systems to analyse complex criminal and paternity DNA cases. This also produced new methodology for estimating DNA mutation rates.

These legally inspired investigations highlighted the many logical subtleties and pitfalls that beset evidential reasoning more generally. To address these, I developed and directed a large-scale 5-year interdisciplinary Leverhulme Research Programme *Evidence, Inference and Enquiry*, which brought together 11 Departments across 7 Faculties at University College London to seek out common ground, to advance understandings, and to improve the handling of evidence.

Last updated December 1, 2023