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Book Reviews

Books for review are to be sent to the Book Review Editor Arne Sandström, Statistical Research Unit, Statistics Sweden, S–115 81 Stockholm, Sweden.

Bibby, J. (Ed.), Quotes, Damned Quotes, and ....., Demast Books, 1983, ISBN 0-946544-00-X, 52 pp., Available from John Bibby, 33 Haugh Shaw Road, Halifax HX1 3AH, England, at £3 including p&p. International transfers may be made to giro a/c 19 875 2008.

When John Bibby, the compiler of this amusing little book, was in Tangier he read in a local newspaper that the well-known phrase *Lies, damned lies and statistics* was attributed to Sir Winston Churchill. In disbelief, he wrote to several journals asking their readers if they knew the phrase's origin. The readers were also requested to send their favorite statistical quote to him. Over three hundred and fifty correspondents submitted material. Bibby sorted, edited, and compiled the responses which resulted in this collage of sayings, epithets, and witticisms.

And what a fantastic collection of words indeed! A gold mine for both lovers and haters of statistics. I know *one* person (my wife, of course) who does not believe statistics is a science (!). She will definitely love this book:

"Statistics – a lot of numbers looking for an argument."

(Mrs. W. Kilbride)

"If there are three statisticians on a committee, there will be four minority reports."

"Variance is what any two statisticians are at."

"The aim of science is to seek the simplest explanation of complex facts ... seek simplicity and distrust it."

(A.N. Whitehead)

On the other hand, I know other people who believe in statistics, and they too will love the book:

"To understand God's thoughts we must study statistics, for these are the measure of his purpose."

(Francis Nightingale)

"But to *us*, probability is the very guide to life."

(Bishop J. Butler)

"Statistics are like a bikini. What they reveal is suggestive, what they conceal is vital."
(Aaron Levenstein)

Of course, I cannot reprint the entire book, but it is difficult to stop:

"He uses statistics as a drunk uses a street lamp, for support rather than illumination."
(Andrew Lang)

The book contains not only one-liners, but also short stories, ballades (e.g. "Ballade of Multiple Regression" by Tom Corlett), poems, etc. Many distinguished people have lent their assistance, such as Goethe, Shakespeare, Twain, Byron, and Galton. The oldest quote is from Ovid (43 B.C. – 18 A.D.). The witticisms are randomly ordered (with some reprinted twice), so it may be hard to locate particular phrases that you have heard before. The entries could have been ordered according to the sources (if known), or according to headings such as "Lies," "Learnings," or "Philosophical."

This is a very useful book. The quotes can be read for amusement, used in after-dinner talks, put on place-cards at smaller dinners, or, of course, employed to entertain your students. Therefore, buy it and enjoy yourselves.

But what about the quote *Lies, damned lies and statistics*? Well, it is known that Mark Twain wrote that Benjamin Disraeli used this oft-quoted phrase. Bibby does not believe this either, and a Disraeli biographer has confirmed his doubts. I will end with a quote by the compiler of this excellent pamphlet: ... *the phrase is more Twain-ish than anything else.*

Arne Sandström
Statistics Sweden

PS If you have a favorite "damned quote," please send them to me so I can pass them on to John Bibby. Why send them to me and not directly to John Bibby? I want to be the first to read them, that's why. DS

DeMaio, T.J. (Ed.), Approaches to Developing Questionnaires. Statistical Policy Working Paper No. 10, United States Office of Managemant and Budget, November, 1983, 164 pp.

This is a monograph prepared by a subcommittee on questionnaire design of the Federal Committee on Statistical Methodology. It is a government document that covers in great detail a part of the survey research process that is not given much attention in most general textbooks on survey research methods. Every survey research project incorporates a questionnaire either for use by interviewers or by the respondents themselves. Therefore, a monograph which provides information on alternative strategies for producing an instrument that will generate high quality information is very useful.

The monograph primarily focuses on the pretesting process with some attention given at the beginning to the generation of questions. There are three major parts to the monograph: (1) a section on methods for developing questions, (2) a description of procedures for testing the draft questionnaire and (3) techniques for determining whether particular questions are problematic. Each chapter uses the same structure for its presentation: an introduction, a methods section divided into personnel and skill requirements, selection of respondents, preparation, operation, time considerations, cost considerations, mode of data collection and finally an example of use of the technique in a recent study.

After an introductory chapter, the next three chapters describe methods of developing questions. These methods are unstructured individual interviewing, qualitative group interviews, and participant observation. The chapters provide specific instructions as to how to carry out these techniques. Although many researchers will have had experience with the first technique, the remaining two are less often used. The recommendation to benefit from the experiences of a participant observer by using him/her in the questionnaire drafting and review stage is quite intriguing.

Other question development processes are not discussed much. In particular recommendations to review other studies and to base question objectives on theory are not covered well. The editor actually adds some description

of these procedures in the introduction to the next section. However, this is not enough treatment for these valuable guides to question development. We have all experienced at one time or another during the analysis phase the disappointment of not including a needed section of questions in the survey. We have also seen many questionnaires that are longer than necessary, because the investigator thought the questions might provide some interesting information and then the questions never get analyzed because they were superfluous.

Chapters 5 and 6 describe informal and formal testing of the questionnaire draft. The primary difference between the informal and formal mechanism is the existence of quantitative information upon which to assess the draft questionnaire. The informal methods use subjective judgements of interviewers and observers. The formal methods included for discussion were pilot studies and split sample techniques. Separating these methods makes it easier to describe them, but it also gives an implicit message that one would want to choose one approach over the other, rather than what is more common, to use a combination of these procedures.

The remaining five chapters focus on specific techniques for evaluating the quality of questions and the data they produce. Again the reader should not be mislead into thinking that only one technique is to be used. The first three chapters in this section describe how to use three different sources of information to determine question quality – the respondent, an observer, and the interviewer. Each of these techniques includes procedures that produce a range of information from qualitative to quantitative. The more quantitative information that is produced the more formal the testing. Many of these techniques are relatively inexpensive and add relatively little time to the project schedule. The last two chapters in this final section describe procedures for conducting record checks and collecting data from respondents in self-administered strategies on steps they took to answer the questions.

There is no summary chapter at the end of the monograph, but it would have benefitted from one. In particular a summary chart comparing the elements and outputs from the various procedures would have been helpful. One of the monographs strengths is also its weakness. Each chapter is written with the exact same structure. For some techniques this produces a stilted discourse. On the other hand, it makes it relatively easy to compare alternative approaches on critical dimensions. The inclusion of an example of each technique described is helpful. It provides a good sense of how the technique is carried out and the nature of the information produced from it upon which decisions can be based. Although written for those with relatively little research experience, the organization in one report of various questionnaire development techniques makes this a useful volume for every survey researcher to read.

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Diggle, P.J., Statistical Analysis of Spatial Point Patterns. Academic Press, London, 1983, ISBN 0-12-215850-4, ix+148 pp., £14.95.

Studies of spatial patterns are conducted within many disciplines: astronomy, biology, geography, geology, etc. Such studies are also of interest in environmental statistics, as can be seen in a recent report published by Statistics Sweden (1984).

The statistical methods used in the description and analysis of spatial structures are of comparatively recent origin. Important contributions have been made by an English group of statisticians with M.S. Bartlett as the pioneer. Among other members of the group are J. Besag, P. Diggle, and B.D. Ripley. The time seems to have come for summing up the theory in textbooks and monographs. A comprehensive general textbook was published by Ripley (1981). Diggle now offers a more detailed account of one branch of the theory, viz. the analysis of point patterns.

Examples of point patterns include the arrangement of trees in a forest, nests in a breeding colony of birds, cell nuclei in a tissue, and towns in a geographical region. The present book takes its examples from biology. This

implies a certain restriction, but most of the methods are of general applicability. Another restriction is that only planar patterns are treated. However, as stated by the author, "most of the ideas extend, at least in principle, to other spaces."

In the book, a distinction is made between two types of data: mapped data, where the coordinates of all events[1] are available, and data from sparse sampling. Data of the latter type are either counts of events in sample plots (usually called "quadrats") or of distances from sample points to neighbouring events and distances between neighbours. These and other concepts are introduced in Chapter 1. The section on Monte Carlo tests is of special importance for the sequel.

The following two chapters are also of an introductory nature. The main theme is a test of complete spatial randomness (CSR). The CSR is regarded as a dividing hypothesis to distinguish between "aggregated" and "regular" patterns. Chapter 2 deals with preliminary testing of mapped patterns. Some of the test-statistics recommended are the average nearest neighbour distance and the variance-to-mean ratio in quadrats. Mead's test for randomness on different scales is also discussed. Chapter 3 on the analysis of sparsely sampled patterns deals with similar tests of CSR. It also treats the estimation of the intensity (mean number of events per unit area) from quadrat counts and distance measurements.

Chapter 4 describes various planar point processes. The starting point is the Poisson process equivalent to the CSR. Many types of aggregated and regular processes are discussed such as Poisson cluster processes, Cox processes, Markov point processes, and some cases of inhibition processes and thinned processes. The processes are all stationary in space and usually also isotropic.

The analysis of mapped patterns is treated in Chapter 5. The main theme is the fitting of an appropriate type of stationary and isotropic process to the data. For estimating the parameters of the process, the empirical counterpart of the function $K(t)$ is used. $K(t)$ is an expression of the second-order properties of the process; essentially, it is the expected number of events within distance t from an arbitrary event.

For goodness-of-fit testing, the recommended methods are those based on the discrepancies between observed and theoretical functions $F(t)$ and $G(t)$, that is, the distribution functions of distances from an arbitrary point to the nearest event and from an arbitrary event to the nearest other event, respectively.

The two concluding chapters, 6 and 7, are devoted to multivariate point patterns, i.e. patterns with events of different types, for example trees of different species. The object of a statistical analysis is to explore the possible interdependence between the component patterns. Chapter 6 describes some types of multivariate processes involving independency, or positive or negative correlation between the locations of different types of events. Examples of extreme cases of positive and negative correlation are the linked and balanced Cox processes, respectively. Chapter 7 describes the analysis of multivariate patterns, especially for mapped data. The "inter-type" analogies of the functions K, F, and G, mentioned above, play a role similar to the corresponding functions in the univariate case.

A distinctive feature of the book is a set of six examples discussed from various angles throughout the text. Four of the examples concern the spatial arrangement of trees and other plants, whereas the other two pertain to the location of centers of cell nuclei in microscopic sections of tissue. The corresponding data sets, in the form of rectangular coordinates of the observed events are made available to the reader in an appendix which extends over 18 pages.

An equally distinctive feature is the repeated use of Monte Carlo methods. Even under the hypothesis of CSR, the distribution of a test statistic or an estimate cannot be obtained in analytic form. Therefore, we must have recourse to Monte Carlo simulations of realisations of a process. Consequently, the book describes ways to simulate the various processes that are considered. To take one example: the empirical estimate of a function such as F, G or K is compared with the upper and lower envelopes from a number (usually 99) of simulations of the fitted model. How-

[1] The points under study are referred to as events in order to distinguish them from observation points, etc.

ever, in the case of sparse sampling, the sample points (or plots) are assumed to be sufficiently well separated for the observations to be regarded as independent. This means that traditional methods for treating simple random samples can be applied without any need for simulations. However, as stated by the author, the sparse sampling methods are inherently limited in scope compared to methods for analysis of mapped data.

Owing to the nonavailability of analytic expressions for the distributions in the case of mapped data, it is not possible to develop methods of inference corresponding to one or the other optimality criterion. The methods used are described as intuitive and ad hoc. The performance of the various methods, however, is well illustrated by examples and simulations.

The author has given a very lucid presentation of the subject with a happy balance between theory and applications. By the repeated recourse to the illustrative examples and a generous use of graphics, the methods and ideas are accessible even to readers with a rather moderate background in mathematics and basic statistical theory. Moreover, the use of Monte Carlo methods means that these readers are spared many mathematical complexities.

All in all, this is a very good book. It should be of interest not only to biologists but also other scientists, such as geographers involved in studies of spatial patterns. Statisticians dealing with environmental and other areal statistics should find the book of interest.

References

Ripley, B.D. (1981): Spatial Statistics, John Wiley & Sons, New York.

Statistics Sweden (1984): Den rumsliga redovisningen i areell statistik. Idépromemoria, Avdelningen för areell statistik, mars 1984 (in Swedish).

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Greenacre, M.J., Theory and Applications of Correspondence Analysis. Academic Press, London, 1984, ISBN 0-12-299050-1, 376 pp., £ 34.

In France, a statistical method referred to as *Analyse des Correspondances* (usually translated *Correspondence Analysis*) is a well-known and frequently applied scientific tool. In countries where French is seldom spoken, the method is little known. This is particularly the case in the English-speaking world.

The main reason for this lack of interest in the method outside France concern problems of communications. Not only are most articles on Correspondence Analysis written in French, but they have also been "couched" in extremely vigorous algebraic notations. This complex "language" has almost completely closed the lines of communication with the Anglo-American statistical schools, which have traditionally adopted a much more pragmatic notation style.

Correspondence Analysis is a method conceived by Jean-Paul Benzécri and was created for use in linguistics. It is based on the philosophy of Data Analysis, i.e. inductive reasoning proceeding from the specific to the general. This standpoint is stated: "The model must fit the data, not vice versa." (J.P. Benzécri's second principle of Data Analysis.) Benzécri's first principle is that "Statistics is not probability" and that "authors (who hardly ever write in our language) have erected a pompous discipline, rich in hypotheses which are never satisfied in practice." The latter statement has tended to provoke the anger of other scientists rather than convince them of the advantages of Correspondence Analysis.

In order to reduce the communication gap between Benzécri's group in France and the Anglo-American statistical schools, Michael J. Greenacre has written a book called Theory and Applications of Correspondence Analysis. His goal is to introduce the method to English-speaking researchers in various fields since he considers the method tremendously versatile for application in almost any scientific area.

Thus, the book is written for both statisticians, who are familiar with matrix algebra (but not necessarily with the geometric aspects of vector algebra), as well as for researchers without such knowledge.

Greenacre finds it unfortunate that so much

emphasis has been placed on a model as a representation of reality, but with so little attention paid to its ability to describe data meaningfully. The relevance of Correspondence Analysis is simply that the gain in interpretability far exceeds the loss in information.

The name Correspondence Analysis originates from the system of associations between the rows and the columns of the data matrix. The aim of the method is to obtain a graphical display where both rows and columns are represented.

As the Anglo-American statistical schools are rather unfamiliar with geometric concepts in linear spaces, Greenacre devotes one chapter to this issue. The presentation of the method itself starts with a few simple examples. A formal mathematical treatment is then given of Correspondence Analysis as well as of other analyses which are algebraically equivalent. It is further discussed how the method can be applied to qualitative data. Greenacre also explains how to use Correspondence Analysis in Discriminant Analysis, Classification, Regression Analysis and Cluster Analysis. He discusses the stability of the graphical displays obtained by Correspondence Analysis as well as their probabilistic properties in appropriate situations.

The last chapter consists of several applications within many fields, such as genetics, social psychology, clinical research, education, criminology, food science, linguistics, ecology, paleontology and meteorology. In Appendix A, the crucial concept of the Singular Value Decomposition and its geometry are discussed. Appendix B gives a short presentation of computer application aspects.

Greenacre's book has many merits. He has been successful in translating the French ideas into a language understood by Anglo-American school statisticians. The mathematical and statistical chapters contain a plain and cogent presentation of the concepts and matrices used. The "practical" chapters are written using a minimum of mathematics and instead concentrate on geometric configuration.

I recommend the book to statisticians who want to learn this interesting and often applicable method. Researchers in other scientific fields, without knowledge of matrix algebra, should also be able to grasp many of the merits of the method.

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Hald, A., Statistical Theory of Sampling Inspection by Attributes. Academic Press, New York, 1981, ISBN 0-12-318350-2, 532 pp., $ 84.

The book is divided into three segments. Part 1 (Principles, Results and Applications) is written at a "non-mathematical" level and is divided into 8 chapters. Part 2 (Statistical Theory and Proofs) has 10 chapters and contains the theory and details omitted from Part 1 and some more advanced theory. Part 3 (Statistical Tables for Sampling Inspection by Attributes) consists of a brief introduction and 57 pages of tables which can be used for constructing optimum sampling plans. Another useful feature for a researcher is the 13-page list of references, many of which predate the indispensable *Current Index to Statistics* (1975–).

The author believes that Part 1 used in connection with Part 3 will be useful to the practitioner. He states that it should be easy to read by engineers who have an elementary knowledge of quality control. This reviewer suspects that few engineers will have the background to make this assumption realistic. Unless the reader is reasonably familiar with the standard discrete distributions (binomial, hypergeometric, Poisson) and has some exposure to the concepts of statistical inference (and some sampling inspection plans), he may find that material quite difficult. Further some perseverance is required to follow the numerical calculations which are based upon approximations and tables.

Part 2 is certainly invaluable for someone doing research in quality control. Here the author assumes that the reader has an "elementary knowledge of mathematical analysis and distribution theory". To this reviewer this interprets as a good mastery of calculus, the ability to do most of the exercises in the first 5 chapters of Hogg and Craig (1978) or the first 7 chapters of Mood, Graybill and Boes (1974), and the possession of good manipulative skills. Most chapters in Part 2 are concluded with problems and exercises, some of which could be used in an introductory course in mathematical statistics.

Now for more details, particularly about Part 1. The title of Chapter 1 is "Fundamental Concepts". Here one finds some well-worded definitions (there is a shortage of these in statistical literature) and some comments

based upon years of experience. Among the topics which receive a brief introduction are cost and regret functions, prior distributions, outliers, lot tolerance percent defective (LTPD), average outgoing quality limit, acceptable quality level, a linear cost model, Bayes and restricted Bayes sampling plans, consistency and efficiency. Some notation is introduced.

Chapter 2 is "Single Sampling Plans Based on the OC Function." The main problem considered is that of finding minimum sample size and the corresponding acceptance number satisfying the conditions (plans of given strength).

Operating characteristic
$\leq \alpha$ for satisfactory quality
$\geq 1-\beta$ for unsatisfactory quality
given that the appropriate distribution is either the binomial, hypergeometric, or the Poisson. Formulas based on asymptotic results and requiring the special tables of Part 3 are given. There is some discussion of the situation in which α and β are decreasing functions of the lot size N. Chapter 3 (Multiple Sampling Plans) covers plans of given strength for double sampling, multiple sampling and the sequential probability ratio test (SPRT). Chapter 4 is entitled "The ISO 2859 Standard and Military Standard 105D" and a short discussion of these documents is presented.

Chapter 5 (Dodge-Romig LTPD System and its Generalizations) and Chapter 6 (The Dodge-Romig AOQL System) give brief discussions of LTPD and AOQL sampling plans, including the finding of plans which minimize the average total inspection (ATI). One interesting feature is the generalization of ATI to a linear cost function.

Chapter 7 (Bayesian Sampling Plans) and Chapter 8 (Restricted Bayesian Sampling Plans) conclude Part 1. Here the linear cost function is used and it is assumed that the fraction defective is constant while a lot is being formed but changes from lot to lot, being governed by a (beta) prior distribution. The Bayesian plan is the one which minimizes the mean cost per lot while the restricted Bayesian plan minimizes that average cost subject to a side condition. Again solutions are given based on asymptotic results and requiring special tables contained in Part 3. Mentioned also is the defects per unit model employing a Poisson with a gamma prior.

Except for Chapter 10 (Double Sampling Plans for the Normal Distribution) and Chapter 18 (Some Related Topics), Part 2 is mainly concerned with presenting the theoretical details for the material in Part 1.

Professor Hald writes very well and is a careful proof reader. This, together with his long years of careful research and experience, has led to an excellent book. Everyone who considers himself an expert in quality control should have a copy (dispite the rather high price).

One of the reasons that so many mathematical details and tables are required is that (approximate) explicit solutions are sought for systems of equations and inequalities that do not permit exact, explicit solutions. The practical way for dealing with such problems is to use the computer and get exact solutions. Here at the University of Wyoming, interactive computer programs are available which can be used to solve most of the problems which are discussed in this book. Even without approximate solutions for a starting point, it is possible to home-in on the exact solution rather quickly. Anyone who has ever computed (or tried to compute) the OC or the ASN (average sample number) for curtailed double sampling with a binomial, hypergeometric, or Poisson can really appreciate how much more pleasant life can be if one lets a computer do the work. In addition those clever machines make it almost impossible to commit an arithmetic error. With a good computer package the story of this book could be reduced to about 40 to 50 percent of the 515 pages.

References

Current Index to Statistics (1975–): Published jointly by the American Statistical Association and the Institute of Mathematical Statistics. (IMS Business Office, 3401 Investment Blvd. No. 7, Hayward, CA. 94545, USA.)

Hogg, R. V. and Craig, A. T. (1978): Introduction to Mathematical Statistics (4th ed.). Macmillan Publishing Co., Inc., New York.

Mood, A. M., Graybill, F. A. and Boes, D. C. (1974): Introduction to the Theory of Statistics (3rd ed.). McGraw-Hill, New York.

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Jowell, R. and Airey, C. (Eds.), British Social Attitudes. The 1984 Report. Gower, Aldershot, 1984, ISBN 0-566-00737-1, 164 pp., (paperback), £ 10.40 (Hardback, £ 19.95).

British Social Attitudes is an overview of current attitudes, values, and beliefs on central political and ideological questions. It is presented as a complement to the more objectively oriented *Social Trends*, a report based on the type of traditional social-welfare and level-of-living statistics that are compiled in various forms in a number of countries.

To define and measure public attitudes is a desirable but technically difficult task. The authors stress that although public attitudes are as much a part of social reality as are behavior patterns, social conditions, and demographic characteristics, the measurement of these attitudes has never been accorded the same priority in official statistics. The information presently available derives from a patchwork of unreconciled ad-hoc surveys with no comprehensive approach. This kind of information is also frequently considered controversial, despite (or perhaps because of) the importance attached to public opinion in decision-making. In particular, Scandinavian social research and comprehensive surveys focus on objective elements of living conditions. Internationally, subjective aspects have received more attention.

British Social Attitudes was planned as a series of annual reports in which trends would be followed up by means of annual surveys. The first survey (a sample of 1 700 adults, with a nonresponse rate of 30 per cent) was initiated and conducted by Social and Community Planning Research (SCPR), an independent, nonprofit institute. The data, obtained from about 300 questions on attitudes, values, and beliefs on current political and ideological issues, are available for further analysis in the ESRC Data Archive. The chapters in the first report are headed Political Attitudes, Economic Policy and Expectations, Social Policy and the Welfare State, Educational Issues and Priorities, and Social and Moral Values.

The report is easy to read, and it is of great interest not only to an English but also an international audience. Almost without exception, the topics studied are relevant to most developed countries, and non-British readers will find many suggestive and surprising items when comparing the findings with their own ideas or knowledge about attitudes, norms, and beliefs in their own countries. The book also gives a feeling about the reliability of the interview data.

The vast range of issues covered by the survey gives the material its unique value but also constitutes its weakness. Attitude estimates are commonly based on a single interview question, although the complexity of the topic frequently requires a more elaborate questioning technique and a greater number of questions. In spite of the care given to the formulation of the questions, it has nevertheless been difficult to adhere to the fundamental principle of statistical surveys, namely uniformity of definition.

In the reviewer's opinion, this type of very simple attitude surveys is justified, but we have to accept that from a technical point of view the extent of the survey field constitutes a problem. *Absolute* estimates (e.g., the number of persons in favour of a certain measure) will be unreliable, as they will be influenced by such items as the conceptual limits set by the interview question and the nuances in the formulation of the question. In other words, the frame of reference from which the reply is given will vary among the interviewees and will consequently be of greater interest. The authors thus point out that the main purpose is to measure *changes* during the 80's, and not to measure absolute levels in a given year. For these comparisons over time, they assume that the stimuli situations of the interview will remain constant, that the nuances in the formulations retain the same value, and that the reference frames remain unchanged. The financing of annual surveys during a five-year period has been secured.

Another type of comparison, which increases the value of the surveys, can be made when international data collected with exactly the same kind of questioning technique become available. Harmonization with surveys in the United States (NORC) and West Germany (ZUMA) is planned. A third type of comparison, viz. of groups covered by the survey, is already made in the report. In such comparisons of age groups, socio-economic groups, geographical areas, etc., the interview situation is assumed to be largely the same. Of course, we may question the extent to which the idea about constant stimuli situations is

realistic in comparisons over time, and between different groups and cultures.

In one respect, the authors are too optimistic, namely as regards their plans to requestion half of the first year's respondents and to compare individual as well as aggregate attitudinal changes. The effectiveness of a panel approach over *short* time periods can be doubted, since the "noise" from measurement errors, particularly in attitudinal data, is very high compared with real changes. A series of re-interview studies using identical samples and other similar studies carried out at Statistics Sweden seems to indicate that the turnover during a period of a few weeks is 5–10 per cent for objective indicators and up to 20 per cent for indicators with a subjective element[1]. This instability, which is due to vaguely formulated questions and oscillations in attitudes, invalidates short-term panel analyses of attitudinal changes. Survey data, especially attitudinal data, seldom attain the quality prerequisites necessary for panel analysis[2].

Below, some interesting findings on current British public opinion are given, as well as findings illustrating the difficulties in interpreting attitudinal data in an absolute sense.

On the classical issue – low inflation versus low unemployment – 69 per cent of the sample think the government should give priority to the latter. Sixty-one per cent support government incentives to encourage job sharing or splitting. Sixty-one per cent expect their wages to rise more than the cost of living next year, and 67 per cent are managing "very well" or "quite well" on their income "these days."

Findings also indicate that only 31 per cent of the sample assert that there on some occasion has been a law "considered by Parliament" which they thought was "really unjust and harmful"! Fifty-three per cent state that people should obey laws "without exception", and only 30 per cent can imagine circumstances in which they themselves might break a law to which they were strongly opposed. Seventy-two per cent feel that "people who wish to overthrow the system of government in Britain by revolution should not be allowed to teach in schools."

On the theme of the welfare state, 65 per cent of the sample feel that "large numbers of people" falsely claim benefits, while 81 per cent say that "large numbers" fail to claim benefits. Only 6 per cent give social security benefits highest priority for extra spending (defence: 4 per cent, subsidies to industry: 16 per cent). However, 55 per cent think that "there is such a thing as poverty in Britain today," and 26 per cent perceive the existence of poverty in Britain in absolute terms ("shortage of absolute necessities such as food and clothing").

Four per cent of the population say that "close links" with the U.S. are "not important," as compared with 33 per cent in the case of U.S.S.R. The meaning of "close links" – not defined in the question – obviously may vary in these cases.

Finally, who would be frank enough to describe him- and herself as "very prejudiced against people of other races"? Only 4 per cent of the population in fact give this answer. However, 28 per cent of the same sample oppose the idea of a law against racial discrimination, 10 per cent would "mind a lot if an Asian or Black was appointed as their boss," one-third would "mind a lot if a close relative were to marry an Asian or Black," and 67 per cent think Britain should allow fewer Indians and Pakistanis to settle there.

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[1] Test-retest reliability studies controlled for actual turnover.

[2] See also the article by Thorslund and Wärneryd in this issue.

Land, K. C. and Rogers, A.(Eds.), Multidimensional Mathematical Demography. Academic Press, New York, 1982, ISBN 0-12-435640-0, xiii+605 pp., $ 33.

A conference on multidimensional mathematical demography was held at the University of Maryland in 1981 as an attempt to take stock of recent developments. The conference papers contained in the present volume are intended as a source of reference to scholars in demographic sociology and other fields who wish to pursue research on the subject.

Background

In recent years new methods have appeared for estimating life tables, generating population projections, and carrying out analyses of growth patterns. An important feature of these new methods is the inclusion of dimensions other than the natality-mortality of classical mathematical demography. Partly as a result of theoretical developments, there have also appeared new and innovative empirical applications to the study of migration patterns, marriage formation and dissolution, and labor force participation. Such substantively diverse problems were found to have a common unifying analytic thread: a set of states among which the members of a population make transitions. It thus became clear that projections of populations classified by multiple states of existence could be made using a common methodology based on a core model of population dynamics. The basic stochastic model used here is that of the classic discrete state, continuous time Markov chain.

Models combining the age dimension with one or more states are called multidimensional models. There has been an underlying need for consistencies in multidimensional population projections since single state projection models exhibit serious deficiencies. National statistical agencies have begun to respond to an increasing interest among a large number of users by publishing data needed for fitting such models. Besides being of interest to demographers, these problems are related to other fundamental phenomena, to social and economic change, and to various social policy issues.

Review of Contents

The participants, representing a diversity of disciplinary backgrounds, were asked to address certain issues in their papers. The contributions have been grouped in the volume under the following four main themes:

1) Data problems
2) Life tables
3) Population dynamics
4) Heterogeneity.

The data requirements of multidimensional demography grow rapidly with the number of dimensions. Required are data on population flows, while often only aggregate data from censuses or surveys are available. There are two papers on data problems. First, Frans Willekens discusses multidimensional population analysis with incomplete data, proposing a five-step procedure to estimate missing values based on a log-linear model. The second paper, by Rogers and Castro, is concerned with model schedules. When the requisite data are unavailable or grossly inaccurate, model schedules – sometimes referred to as systems, e.g., the well-known Brass system – are used as substitutes for empirical schedules. Rogers and Castro consider model schedules for migration, an area in which data problems are especially troublesome and omnipresent.

The life table has been a central and very successful concept in classical demography. Chapters 4–6 in the volume deal with the construction of multidimensional life tables. The section starts with a 109-page long, critical review of multidimensional life table methodology by Jan Hoem and Ulla Funck-Jensen. Looking at demographic praxis from the wider perspective of mathematical statistics, the authors distinguish between:

(a) the probabilistic model, e.g., a discrete state, continuous time Markov chain;
(b) numerical methods used to compute derived quantities, e.g., transition probabilities from transition intensities;
(c) statistical methods to be used when the model is applied to real data, including observational plans (ascertainment methods).

According to the authors, statistical methods are not kept sufficiently in the foreground, and different competing approximations and computational methods tend to obscure the central issue, which is the application of an essentially simple stochastic theory.

Further discussion of statistical methods for Markov-generated increment-decrement life tables (IDLT) is given in the paper by Land and Schoen which follows. As noted by the authors, there has been a long tradition in demography to focus on computational methods, using expressions such as "calculate an IDLT" instead of the more accurate "estimate an IDLT." Ledent's article concludes the section on multidimensional life table methodology. He is concerned with the estimation of transition probabilities on the basis of census or sample data rather than population register data.

The third conference theme – population

dynamics – is treated in a section which contains both theoretical papers and substantive applications of multidimensional models. Leading off is Robert Schoen's essay on the incorporation of the interaction between the sexes in life-table and stable population models. Multistate demography is concerned with projecting changes of status as experienced by individuals. Multiple decrement tables such as marital status tables of educational life and multiregional tables, are all members of a general class of IDLTs designated multistate life tables. The object with these is to produce consistent disaggregated projections that follow the evolution of subcategories of a population over time. Philipov and Rogers, addressing the same theme, are concerned with multiregional population projections. Joel E. Cohen, in a more theoretical essay, discusses multiregional age-structured populations. His objective is to describe population models in which serial and parallel inhomogeneity are combined as well as to give ergodic theorems for these models.

Finally, heterogeneity is the last of the four main themes of the volume. In describing mobility processes, a popular hypothesis is that the process is Markovian. In this approach, the population is assumed to be homogeneous with respect to mobility. A mover-stayer model was introduced to differentiate between those with zero probability of moving and those with a positive probability of moving, "stayers" and "movers" respectively. Kitsul and Philipov consider an extension of the mover-stayer model: "A High- and Low-Intensity Model of Mobility" is the title of their contribution. Charles J. Mode's paper contains a sample path perspective on multidimensional demographic models. The sample path is the set of states visited by an individual with the sojourn times in these states over a period of time. Sample paths and their associated distributions are a primary concern for the design and implementation of computer simulation models.

In the last chapter of the volume, Heckman and Singer continue the discussion on population heterogeneity in demographic models. Analyses made on large longitudinal data sets, recently made available, have shown that the assumption of Markov first-order dependence is questionable. Heckman and Singer propose mixtures of waiting-time distributions as an alternative in the presence of heterogeneity.

Impressions

Conference proceedings often contain contributions of highly varying quality and many papers of only marginal interest. This is not the case here. Qualified people were invited to the conference, and they were specifically asked to focus on the four main topics mentioned previously. However, the reader will find a certain amount of overlap in the volume. Inevitably, introductions to the chapters reiterate many of the same views and arguments. Moreover, the basic Markov model and the ideas behind an increment-decrement life table are given more than once. Of course, this would never occur in a well edited textbook. I suppose this is the price we must pay for being made familiar with recent, ongoing research in the field. In ten years time, much of the material presented here will be standard and included in textbooks on demography.

Being a statistician myself, I find it commendable that both probabilistic ideas and statistical problems are brought into the foreground by many of the contributors. In the past, there has been a tendency for demographic texts to focus excessively on purely computational problems.

The volume contains both review articles and more specialized papers, although the latter are all fairly easy to read. An abundance of references are included, especially in the review articles. The essay by Hoem and Funck-Jensen alone has a list of references comprising 138 titles! This should make the present volume useful to researchers and practitioners in demography, sociology, statistics, and other fields, as well as to students in the same areas.

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Ratkowsky, D. A., Nonlinear Regression Modeling: A Unified Practical Approach. Statistics: Textbooks and Monographs, Vol. 48, Marcel Dekker, New York, 1983, ISBN 0-8247-1907-7, 276 pp.

In this book, the author discusses the practical aspects of parameter estimation in nonlinear models, especially in biology, forestry, chemistry, physics and agricultural science. The purpose is to instruct the reader and user of nonlinear regression models how to examine a nonlinear model $Y = f(X,\theta)$ where f is a nonlinear function of the parameter θ. Given the data $(X_1, Y_1),\ldots, (X_n, Y_n)$ of n independent observations of the response variable Y and the independent variable X, how should we estimate θ? The thesis is that we should search for least squares estimators of θ by means of the Gauss-Newton algorithm. Having found the least squares estimate $\hat{\theta}$ of θ, the suitability of the model $f(X,\theta)$ should be analysed according to a scheme including measures of the solution locus of $\hat{\theta}$, bias of $\hat{\theta}$ and simulation studies.

In Chapter 1–2, the consequences of the "nonlinear behaviour" of a model are very briefly discussed. The LS-estimate of $\hat{\theta}$ cannot be found analytically if $f(X,\theta)$ is nonlinear. Therefore, we must solve for θ by iterative algorithms. The properties of the solution surface of $\hat{\theta}$ could be used to describe the "nonlinear behaviour." Different statistics have been suggested for characterizing nonlinear behaviour such as measures for *intrinsic nonlinearity* and *parameter-effects nonlinearity* (Bates and Watts, (1980)). The discussion of these curvature measures in Chapter 2 include a measure of the bias of the LS-estimator in nonlinear models due to Box (1971). The author is only stating results and indicating the estimation problems. References are usually made to other sources, such as Jennrich (1969) and Malinvaud (1980). The discussion also covers the information matrix, the fit of a model, test for normality, and the construction of confidence regions for the parameters using methods proposed by Gallant (1976). The author illustrates how to use simulation to reach conclusions about the properties of the LS-estimators and the proposed algorithm. These chapters end with two appendices where the Gauss-Newton method of iteration and the curvature measures due to Bates and Watts (1980) are explained.

In Chapters 3–6, the properties of various nonlinear models with real data sets selected from agriculture, biology, and engineering sciences are discussed. The relationship between the yield of a crop Y and the density X of planting, is the subject of great interest in agriculture and a variety of mathematical functions have been proposed to describe the relationship. The author examines the following yield-density models in Chapter 3:

$$Y = (\alpha + \beta X)^{-1},\ Y = (\alpha + \beta X^{\Phi})^{-1}, \text{ and}$$

$$Y = (\alpha + \beta X + \gamma X^2)^{-1}.$$

The parameters of the models are estimated using data sets shown in an appendix. The nonlinearity of the models are discussed employing the curvature measures of Bates and Watts. Several conclusions are made using simulation. The chapter ends with some comments on the choice of a yield-density model.

Sigmoidal growth models are studied in Chapter 4, including Gompertz, logistic, Richards, Morgan-Mercer-Flodin (MMF), and Weibul type models. The models are estimated using four data sets. On the basis of the estimated measures of curvature and the bias according to Box, some conclusions are made with respect to the choice of a suitable growth model. This discussion is supported by reparameterizations of the models and simulation studies.

In Chapter 5–6, miscellaneous models in biology, chemistry and engineering are discussed according to the approach described earlier.

Chapter 7 is devoted to the comparison of estimates from more than one data set following Mead (1970). Chapter 8 is concerned with the problem of finding good initial parameter estimates for the Gauss-Newton algorithm in connection with the earlier discussed models. No general conclusion of approach is reached. Some hints are offered, which the author calls "a sample of total possibilities."

In Chapter 9, the author sums up in the direction of what he calls a "unified approach to nonlinear regression modeling." In an appendix the author provides listings of FORTRAN subroutines, which enable the reader to adopt the approach to nonlinear models advocated by the author. The subroutines have been written to comply with

U.S.A. Standard FORTRAN X 3.9–1966 (ANSI 1966) and requires access to the LINPACK package (Dongarra et al. (1979)). The FORTRAN subroutines are easy to read due to the excellently documented comments. I have not tested the subroutines, but it seems to me that it would be worth the effort to implement the subroutines in a researcher's FORTRAN library.

The book is intended as a textbook at the undergraduate or graduate levels. Over 50 end-of-chapter exercises with detailed solutions are included.

The data sets included and the solutions offered by the author make the book suitable for the researchers in the field of agriculture and biology and connected research fields.

The reader's background in statistical methods according to standard textbooks such as Draper and Smith (1981) is assumed. In order to benefit from the book, the exercises should be performed with the software provided in the book or similar software. A necessary prerequisite is knowledge of FORTRAN programming and computing. The book should be supported by other books in the field since the treatment of statistical inference is very weak. The approach is completely practical and often ad hoc. Maximum likelihood estimation is not mentioned, nor are nonlinear models in econometrics. If one is interested in robust estimation, the book will be disappointing, and rightfully so since the cover of the book claims that it is "the only available work in this field focusing on statistical properties of the parameter estimates." It is also said to be "The reference for all statisticians." The book could be improved from a pedagogical point of view. For instance, there are no suggestions for the order in which the chapters should be read. There should be. In exercise 3.4 following Chapter 3, the reader is told to carry out simulation studies consisting of 1 000 trials for three specific models. To ensure convergence of the proposed estimators, the reader is referred to methods described in Chapter 8. Despite the drawbacks mentioned as well as the occasional lack of clarity, the book can be used as supplementary reading from a data-oriented approach.

References

Bates, D. M. and Watts, D. G. (1980): Relative Curvature Measures of Nonlinearity. Journal of the Royal Statistical Society, Series B, 42, pp. 1–25.

Box, M. J. (1971): Bias in Nonlinear Estimation. Journal of the Royal Statistical Society, Series B, 33, pp. 171–201.

Dongarra, J. J., Moler, C. B., Bunch, J. R., and Steward, G. W. (1979): LINPACK Users' Guide. SIAM, Philadelphia.

Draper, N. R. and Smith, H. (1981): Applied Regression Analysis. 2nd ed., Wiley, New York.

Gallant, A. R. (1976): Confidence Regions for the Parameters of a Nonlinear Regression Model. Institute of Statistics, Mimeograph Series 1077, North Carolina State University, Raleigh, N. C.

Jennrich, R. I. (1969): Asymptotic Properties of Nonlinear Least Squares Estimators. Annals of Mathematical Statistics, 40, pp. 633–643.

Malinvaud, E. (1980): Statistical Methods of Econometrics, 2nd ed., North-Holland, Amsterdam.

Mead, R. (1970): Plant Density and Crop Yield. Applied Statistics, 19, pp. 64–81.

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