

---

## Book Review: *Seeing Through Statistics*

---

Simon J. Sherwood  
Department of Psychology, University of Edinburgh

A review of *Seeing Through Statistics* by Jessica M. Utts. London: International Thomson Publishing Europe, 1996. Pp. xvi + 464. £21.95, pbk. ISBN 0-534-25776-3. California: Wadsworth Publishing Company.

This book is unlike any other statistics book that I have encountered so far; it uses plain English, it is clear, concise and easy to understand and it is actually enjoyable to read from cover to cover. This book also differs in that its emphasis is on how to understand rather than on how to compute statistics. Focusing on the ideas behind statistics provides a solid foundation that later facilitates an understanding of the formulae and calculations which accompany them. Because most people seem to rely on computers to analyse their data these days, rather than doing the calculations by themselves, it is important that we maintain an understanding of what the computer is actually doing, why and whether it is appropriate. The use of real-life examples and case studies from various media sources helps to convey both the utility and the limitations of statistical methods.

This book succeeds in demystifying statistics and empowers the reader with the confidence and ability to understand, interpret and make judgements based on statistics on a day-to-day basis.

The introductory to intermediate level of this book, together with its emphasis on real-life applications, renders it suitable for a wide audience and it is broadly aimed at consumers, students, parents and professionals. Part 3 of this book 'Understanding Uncertainty in Life' is of particular interest to parapsychologists because it covers probability and chance and factors affecting

people's judgements when they are faced with uncertainty. There is also a chapter on meta-analysis in the latter part of the book. Case studies and examples involving ESP are also used throughout the book.

The book is divided into four parts and consists of 26 chapters. Each chapter is roughly equivalent to the contents of a one-hour college lecture but the book is also designed to be used without any tutorial support. A considerable amount of effort has obviously been put into designing the structure and layout of this book. The boxes that summarise salient points in some chapters are particularly useful. The author writes in a precise manner using simple wording as much as possible and new terminology is clearly defined as it is introduced. The author has also attempted to anticipate and to answer common questions or comments expected from the reader.

Each chapter begins with a number of thought questions to start the reader thinking about some of the issues that will be addressed within the chapter. Throughout each chapter there are numerous case studies and examples that clearly illustrate the points being made. The reader is also taken through any calculations in a step-by-step fashion. At the end of each chapter there are exercises and mini-projects that can be attempted and sections 'For Those Who Like Formulas' that cover the mathematical basis of the statistics. I, personally, was a little put off by the sheer number of

these exercises. However, I can appreciate that these are probably necessary because the book is designed to be read by a wide audience with a possibly differing knowledge of statistics and it is also designed to be used on its own without any tutorial support. In the following paragraphs I will attempt to summarise the topics covered in each part and each chapter of the book.

Part 1 is entitled 'Finding Data in Life' and consists of six chapters which aim to illustrate how data should be collected in order for it to be meaningful. Chapter 1 introduces some of 'The Benefits and Risks of Using Statistics' and gives examples of improper use of statistics in the media. The differences between observational studies and experiments are introduced. The chapter emphasises the need for representative and sufficiently large samples of data and also the need to know information about samples and data collection methods as well as the results when evaluating studies.

Chapter 2 encourages caution in accepting the results of reported studies. Seven critical components that should be considered when assessing or designing a study, such as the source and context of a study, who or what was studied and how they were selected, the measurements taken and the magnitude of any effects, are outlined. The chapter ends with four hypothetical news articles that illustrate bad reporting of studies.

Chapter 3 focuses on the problems associated with defining measurements and illustrates some of the mistakes and misunderstandings that can occur. Problems that can occur when asking people questions are also considered along with the advantages and disadvantages of open versus closed questions. The chapter also looks at different types of variables and the validity, reliability, bias and variability of measurements.

Chapter 4 looks at how to get a good sample of participants and concentrates on different sampling methods such as simple random, stratified, cluster, systematic and multi-stage sampling and also random-digit dialling methods. The chapter also

looks at some of the sampling disasters that can occur such as using the wrong sampling frame or using a haphazard or convenience sample.

Chapter 5 focuses on studies that attempt to detect relationships between variables. The chapter differentiates between experiments and observational studies and considers what constitutes a good design and what can go wrong in each case. The rationale behind randomisation and the use of control groups, placebos, blinding and matched-pairs and block designs is also covered. Explanatory versus response variables are introduced together with confounding variables and possible interactions between variables.

Chapter 6 brings together chapters 1-5 and gives guidelines on how to evaluate a study. Each of these guidelines is then considered in relation to five real-life case studies such as smoking during pregnancy and children's IQ.

Part 2, entitled 'Finding Life in Data', teaches the reader how to summarise data in a useful way, how to detect and quantify relationships between variables, how to detect misleading graphical representations and how to interpret economic statistics. Part 2 introduces what can be done with data once it has been collected and aims to increase awareness of the utility of data and to encourage critical evaluation of results reported in the media.

Chapter 7 focuses on how to organise and summarise data once it has been collected. Measures of central tendency, and variability and the shape of data are considered. Meaningful ways of displaying data in the form of stemplots and histograms are also demonstrated. Other topics include five-number summaries and how to compute the variance and the standard deviation.

Chapter 8 covers the bell-shaped or normal curve and introduces percentiles, standardised and z-scores and familiar intervals. Chapter 9 covers the basic principles that graphical representations of data, such as pie charts, bar graphs, pictograms, line graphs and scatterplots, should and should not follow. This chapter concludes

with a useful checklist of questions that should be considered when viewing graphical representations of data.

Chapter 10 discusses correlation and regression. It considers the strength and the statistical significance of relationships. It also covers the features of correlations and gives examples of both positive and negative relationships. It also looks at specifying linear relationships with regression.

Chapter 11 looks at how relationships can be deceiving and considers some of the problems with and the reasons for correlations between variables. The impact that outliers can have on correlations, especially with small sample sizes is discussed together with what can happen if groups of data are inappropriately combined. Emphasis is placed on the notion that 'correlation does not imply causation' and the author suggests that the only legitimate way to establish causality is to design appropriate experiments.

Chapter 12 looks at relationships between categorical variables and illustrates how to assess the statistical significance of a 2x2 table. One of the case studies in this chapter is based on the Bem and Honorton (1994) paper that investigated whether static or dynamic pictures are more successful as ESP targets. This chapter also looks at relative risk, increased risk and misleading statistics about risk. Also considered is Simpson's Paradox - a situation where there seems to be a relationship between two variables in one direction if a third variable is not considered, but where the relationship seems to be in the opposite direction if the third variable is considered.

Chapter 13 looks at some of the common economic indicators, such as the Consumer Price Index, and their uses. Chapter 14 considers the components of time series data, such as long-term trends, seasonal components, irregular cycles and random fluctuations, and provides a checklist of issues to consider when evaluating reports of time series studies.

Entitled 'Understanding Uncertainty in Life' part 3 aims to help the reader to understand probability and chance and to

enable him/her to make better decisions when faced with uncertainty.

Chapters 15 and 16 cover how to calculate and interpret probabilities for simple events. Chapter 15 looks at the relative-frequency and personal interpretations of probability and the calibration of the personal probabilities of experts. Chapter 15 also covers the rules of probability such as mutual exclusion and independence of outcomes.

Chapter 16 looks at how knowledge about the long-term relative frequency of events can be used to make short-term predictions. Familiar examples such as playing the lottery and betting on sports events are used as illustrations. The chapter also covers long-term gains, losses and expectations and how to use expected values to make decisions.

Chapters 17 and 18 cover the psychological factors that can influence an individual's judgements when faced with uncertainty. Chapter 17 looks at the psychological influences on personal probability. It covers the certainty and pseudocertainty effects and looks at how personal probabilities can be distorted. Also covered is optimism, reluctance to change and overconfidence. Reluctance to change one's own personal probability or beliefs in the face of new data is noted as being one reason why the scientific community and people in general may have difficulty accepting evidence for phenomena such as precognition. The chapter ends with tips on how to improve personal probabilities and judgements.

Chapter 18 looks at what can happen when a person's intuition differs from the relative frequency of an event. It considers coincidences, the gamblers' fallacy and confusion of the inverse. The chapter points out that sometimes people may underestimate the probability of a coincidence occurring and seek an alternative explanation (that could be paranormal) for an event they consider unlikely to have been due to chance. The author points out that although most coincidences might seem improbable for the individual concerned, the probability of the event happening to

someone somewhere might be considerably higher.

Part 4 is entitled 'Making Judgements from Surveys and Experiments' and is more technical than the rest of the book. Part 4 illustrates how inferences about populations can be made on the basis of samples of data. Chapter 19 introduces the notion of generalising from samples to populations. It covers what to expect from sample proportions and sample means. Chapter 20 covers how to estimate sample proportions using confidence intervals.

Chapter 21 covers how to estimate a population mean on the basis of a sample mean. It looks at how to construct a confidence interval for a mean and for the difference between two means. The chapter then looks at some real-life case-studies in order to see how journals present confidence intervals, standard errors of the mean and standard deviations.

Chapter 22 looks at the basic procedures for hypothesis testing that involve determining the null and research hypotheses, summarising the collected data, generating an appropriate test statistic, evaluating the likelihood of the test statistic value if the null hypothesis is true and making a decision as to which hypothesis to accept. The two errors that can be made when hypothesis-testing, i.e. type 1 and type 2 errors, are illustrated using courtroom and medical analogies. A case study based on the ganzfeld procedure is also used to illustrate how hypothesis-testing works in practice.

Chapter 23 looks at some worked examples of hypothesis testing and examines how tests are reported in the media and in academic journals. Hypothesis tests involving proportions and means and chi-square tests for categorical variables are covered.

Chapter 24 looks at what differences between groups actually mean and points out that although test statistics and  $p$ -values can indicate whether there is a relationship or difference between variables, they do not tell you anything about the size of the effect. This chapter also illustrates how sample size can affect the power of tests and thus whether or not relationships or differences between variables will be detected.

Chapter 25 introduces meta-analysis, a topic that seems to be covered in very few introductory statistics books. The chapter explores the two important issues that have to be considered when evaluating or carrying out a meta-analysis: which studies were included and whether the results were compared or combined. Some of the benefits of meta-analysis, such as producing more accurate estimates of small effect sizes, suggesting new avenues for research and/or methodological improvements and the detection of patterns across studies, are discussed. Criticisms of meta-analysis such as the file-drawer problem, the possibility of confounding variables and the possible effects of subtle differences in treatments across studies are also addressed.

The final chapter consists of a series of case studies from newspaper or journal articles. These case studies are designed to enable the reader to apply what has been learnt in the preceding chapters. The salient points are discussed at the end of each article and this enables the reader to evaluate their understanding of the book.

In summary, this is a very readable and easily understandable book. Its major selling points are its emphasis on how to understand the ideas behind statistical methods and its emphasis on applying this knowledge in normal everyday life.

Department of Psychology  
University of Edinburgh  
7 George Square  
Edinburgh EH8 9JZ  
SCOTLAND, UK