

**PENGUIN BOOKS**

**EXPERIMENT, DESIGN AND STATISTICS  
IN PSYCHOLOGY**

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Programmes at the University of Huddersfield.**



Colin Robson

**Experiment,  
Design and Statistics  
in Psychology**

Third Edition



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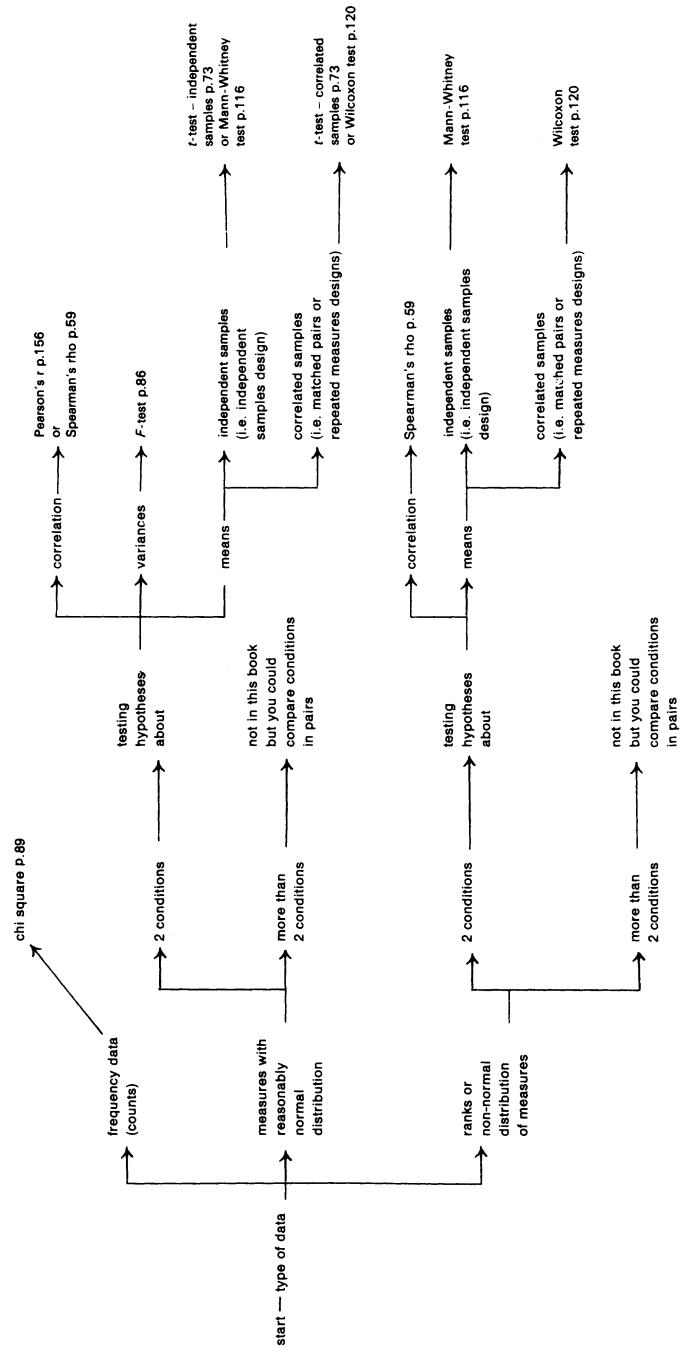
*To my wife*



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## Editorial foreword

There are basic skills which are essential for progress in a variety of subjects, but which often prove to be stumbling blocks for people who otherwise have the necessary ability and motivation. Particularly is this true of various branches of mathematics, especially statistics. Many pure and applied scientists, and non-scientists too, need to have a working knowledge of statistics, and in a large number of cases they develop a block against the subject. A common reaction is to argue that the actual work can be left to the professional statisticians 'as long as I know where to go for help'. This is rather like arguing 'I need not make my car safe because I know where to go for first aid.' The planning of one's own work, and one's appraisal of other people's, is immeasurably improved by *first hand* experience of statistical techniques.

I did not think it was possible to write an introduction to statistics which was positively entertaining, but Colin Robson has succeeded. He is a psychologist and the book is a result of courses given to psychology students, but the techniques which he teaches are the basic ones used in a variety of disciplines. Especially important is the way the author leads the reader into working out examples, because statistics is one of those subjects in which the learner can develop insight as a result of practice. Familiarity becomes a pretty good substitute for a knowledge of the underlying mathematics.

People who understand the mathematics but can also teach the techniques in a simple way are difficult to find. Colin Robson says he is not a Statistician (with a capital S). He is, however, a very good teacher.

B.M.F.

x

## Preface

For a number of years I have lectured on summer courses in experimental psychology, statistics and experimental design at the University of London for external students registered for degrees in psychology. Students on these courses were of extremely varied mathematical background which meant that, if all were to follow the work in statistics, little beyond elementary algebra could be assumed. The core of this book consists of material from lectures and hand-outs presented for these courses. It has been pretty well pre-tested in that the students on these courses were excellent at giving feedback if a particular approach was unclear. While a lot of ground is covered in a relatively small number of words, many of the basic concepts are introduced and reintroduced at several points in the book. This redundancy, which springs from the fact that the material was originally intended for aural consumption, is, I hope, helpful rather than the converse. Similarly, no attempt has been made to alter the informal style in which the material was originally presented.

I am not a statistician, as may perhaps be revealed to any of that breed who read this. However, I have had a good deal of enjoyment in initiating students – particularly those who shy away from anything mathematical and have to be handled with a very loose rein – into the mysteries and delights of designing and analysing experiments.

I am indebted to the literary executor of the late Sir Ronald A. Fisher, F.R.S., to Dr Frank Yates, F.R.S., and to Oliver & Boyd, Edinburgh, for permission to reprint Table 33 from their book *Statistical Tables for Biological, Agricultural and Medical Research*.

## Preface

Finally, I would like to thank the students mentioned above, my wife for her attempts to tame my written style, and Pat Needham and Susan Moorhouse for expert and speedy assistance with typing.

Colin Robson  
1973

## Preface to Second Edition

Since preparing the first edition of this book I have gained further experience in teaching the introductory statistics and experimental design course, mainly with students on the Behavioural Sciences degree at Huddersfield Polytechnic. They have been no less vociferous than the external psychology degree students of London University in indicating any lack of clarity and their resulting confusion. The modifications in this second edition are largely resulting from this interaction.

In particular I am now no longer persuaded by statisticians' arguments as to the superiority of Kendall's tau over Spearman's rho and feel that the computational simplicity of the latter gives it the edge. Pearson's correlation coefficient is covered in an Appendix as it figures in several introductory syllabuses and is useful in introducing ideas needed in more advanced work.

The example used to introduce basic notions about experiments has been brought up-to-date and there is a somewhat more serious attempt to explain the concept of probability. Otherwise the basic approach in the first edition has been retained. I have been very grateful for the feedback I have received both face to face and in written form. Some modifications arise from such comments although I have resisted advice that the book might concern itself more with issues to do with tests and testing, with reliability, validity etc., primarily to keep it as slim as possible.

Much of the drudgery associated with computing, say, a *t*-test, is removed by using the calculator and I would urge all those using this book not only to get a calculator but also to acquire some facility in its use. Given the rapid changes in this area it is not very helpful to recommend specific models. A square root and a memory

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function are useful but I feel that starting out by using the more complex programmable calculators tends to defeat the object of understanding something of the basis of the various tests. Given that understanding there is, of course, a lot to be said for using more powerful machines. Microcomputers have much to offer in this connection and the reader may be interested to know that the statistical tests covered in this book, together with more complex tests, are incorporated in the SUPASTAT programs developed by one of my colleagues for use on the 380 Z and Apple microcomputers.

Colin Robson  
1983

## Preface to Third Edition

The continuing positive response to the second edition of this text might be seen as an excuse for leaving well alone. However, the world changes and so does the context in which the continually increasing numbers of psychology students first come into contact with the requirement to design and analyse experiments. I have also realized that, through my teaching and research experiences of the last decade, I too have changed somewhat in my appreciation of the role and position of experimentation (strictly speaking, that of 'true' or 'randomized' experimentation) in psychology and other sciences involving the study of people. Rather than seeing it as *the* strategy to use, I now look upon it much more as one of a range of possible approaches; as a strategy with undoubted strengths, but also with major weaknesses and limitations in its use. Hence a somewhat more critical approach to the virtues and usefulness of doing experiments has been taken in this edition.

Nevertheless, I remain totally convinced that the student of psychology must acquire not only some understanding of the place of experimental work in the discipline, but also skills in the design, carrying out, analysis and interpretation of such experiments. This text, as in the earlier editions, seeks to 'engage' students in this task. The treatment is deliberately simple without, I hope, appearing condescending. Many potential qualifications and amplifications have been omitted in the cause of not obscuring the main argument. The text has been fully revised with a view to simplifying wherever this seems feasible and helpful, and amplifying where necessary.

One important contextual change is the ready availability for microcomputers of several software packages for the statistical

## Preface to Third Edition

analysis of data. Notwithstanding this, I believe that there is virtue in the student on the *introductory* course in this area not only seeing the statistical formulae used and achieving at least an intuitive understanding of their underlying rationale, but also actually working through at least some of the analyses with data that they have collected. My preference is to make the transition to the use of statistical packages also as part of the introductory course to avoid the danger of the 'statistically challenged' student (who is also likely to be 'computer challenged') persevering with hard-won prowess at hand-calculating *t*-tests and the like. Hence I have continued with the 'step-by-step procedures' and 'worked example' approaches for statistical tests of earlier editions with the expectation that, where facilities are available, tutors will facilitate the transition to use of computer packages as and when they judge appropriate.

I have followed the increasingly common usage whereby those who take part in the experiment are referred to as 'participants' rather than as 'subjects'. While this might smack of pandering to political correctness, the switch is, I feel, of some importance. Asking people to participate in something is different from 'subjecting' them to it. Thinking in these terms may help us to avoid some of the excesses which can arise from the unequal power relationship of experimenter and experimented-upon.

The nature of the text will make it clear that I believe in experimental design and statistics being taught together, preferably in a course which also incorporates the practical work itself. In this connection I would like to commend the recently published *BPS Manual of Psychology Practicals*\* which provides a useful complementary source of practical exercises usable at different levels. I would also like to thank colleagues at Huddersfield and in particular the Behavioural Sciences students who continue to help in my education as we jointly come to terms with modularization, semesterization and learning outcomes. I am also grateful to the many teachers, lecturers and students from other institutions who have

\*McIlveen, R., Higgins, L., Wadeley, A. and Humphreys, P. (1992), *BPS Manual of Psychology Practicals: Experiment, observation and correlation*, British Psychological Society.



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provided invaluable feedback through their puzzlement or appreciation.

Colin Robson  
1993

