Preface

Why you should read this book

A little effort (this is a short book) will help you design better experiments, and designing better experiments will make your life richer and happier and possibly easier! First of all, collecting data to test theories is the very essence of science—no matter what sort of scientist you aim to be, you really need to be able to design good experiments yourself and/or evaluate other scientists' experiments. So don't fool yourself by pretending experimental design doesn't matter to you. We are confident that whether you have never designed an experiment before or whether you have been doing it for some time, there are ideas in this book that will improve your confidence and ability to design and evaluate data collection. Don't fool yourself into thinking that experimental design is an abstruse exercise in applied maths that is beyond you. Flick through this book, there is barely an equation, and we have spent four editions honing our explanations to make them as clear as possible—without a shadow of doubt, if you read this book, then you will understand it and you will be a better scientist for it. At the opposite extreme, be wary of thinking that experimental design is so simple that this book isn't worth your time. If that were true then the world would not be littered with student lab reports with low grades because the student made basic mistakes in experimental design, and manuscripts by professional scientists that will never become published scientific papers for the same reason. If you read this book then for the rest of your scientific life you will design experiments that give clearer answers to more interesting questions, using less of your time, fewer resources, and simpler statistics. Not only that, but you will get more from every scientific paper you read and every scientific talk you listen to. The upshot of these benefits is that you will be a better scientist and a happier person. Given all that, the question really is why on Earth should you not read this book?

Why not to read this book

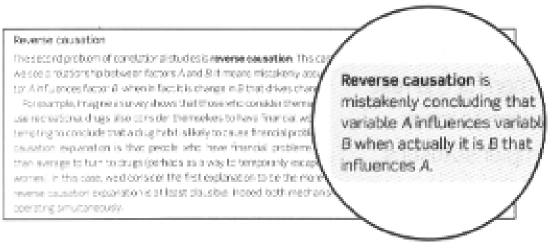
If you want a book on statistics this is not it. We do explore links between experimental design and statistical analysis throughout the book, but this book has very little to teach you about formal statistics. If you want an encyclopaedic tome covering every possible experimental design, then we cannot offer that either: that would be a book at least ten times the size. What we do offer is to give you an understanding of the underlying philosophy common to all experimental designs, and a clear introduction to terminology—these will help you to read books and papers that offer complex designs, but here we only look in depth at relatively simple designs. But 'simple' does not mean 'toy'—the latest issues of the very best scientific journals have articles based on experiments no more complicated that the ones we cover in this book, and most scientists will go through their whole career without having to delve into more complicated designs.

Why we felt the need to produce yet another edition of the book

In truth, some typos aside, there is nothing that was downright wrong in any of our previous editions. With each new edition we have been responsive to feedback from readers and from our own development as scientists to come up with improvements in how we communicate the basic ideas of experimental design. This revision has been much more sweeping that the previous two. We have extensively reorganized and rewritten so as to emphasize linkages between different aspects of experimental design more effectively. Thus we think this book should function both to give you quick answers when you have a very focused question and to give you a solid overview of the overarching concepts of experimental design. From that perspective, we hope that you read the book at least once from cover to cover, and then keep it to dip into quickly as and when required.

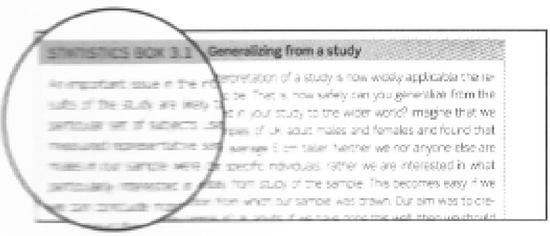
Learning features

Key definitions



There is a lot of jargon associated with experimental design and statistical analysis. We have not tried to avoid this. Indeed, we have deliberately tried to introduce you to as much of the jargon as we can. By being exposed to this jargon, we hope that it will become second nature to you to use—and understand—it. This should also make reading more advanced texts and scientific papers on experimental design less daunting. However, to make negotiating the minefield of jargon more straightforward, we have increased the number of definitions of key terms provided and increased the level of detail in all definitions. Each key word or phrase is emboldened at the point where we first use it, and is given a clear definition in a box nearby.

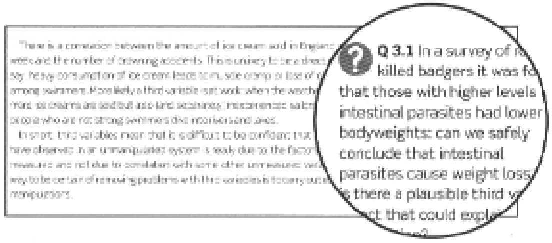
Statistics boxes



To emphasize the important link between good experimental design and statistics we now include a number of statistical boxes. These boxes should help you to see how thinking about design helps you think about statistics and vice versa. We have added the boxes at points where we think that keeping the statistics in mind is particularly useful and include pointers in the main text to each box.

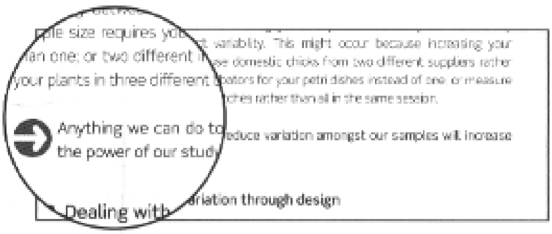
Self-test questions

The more you think about experimental design, the easier designing robust experiments becomes. To get you thinking while you are reading this book, we include a number of self-test questions in every chapter. Often there will not be a clear right or wrong answer to a question, but suggested answers to all questions can be found at the back of the book.



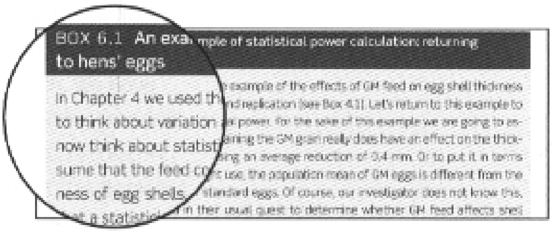
Take-home messages

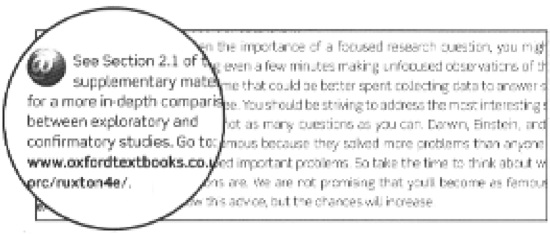
To help to consolidate your thinking, we end most sections with a take-home message. By including these throughout the text we hope to give you an immediate opportunity to evaluate your understanding of a section before moving on.



Boxes and online supplementary material

We have aimed to produce a book that can be read from cover to cover, and so have tried to keep unnecessary details out of the main text. However, in areas where we feel that more details or more examples will lead to a fuller understanding of a concept we have included supplementary boxes. Where there is (to our mind) really interesting material that will not be strictly relevant to all readers, we have not included that material in the book itself, but lodged it on an associated website (www.oxford-textbooks.co.uk/orc/ruxton4e/). We point to this supplementary material at appropriate points throughout the book.





Chapter outlines

Most chapters begin with an outline of the main points covered by that chapter. These outlines should help you to prepare for what is ahead. The outlines will also provide an easy way for you to dip in and out of the book during subsequent readings.

Chapter summaries

Every chapter finishes with a summary of the most important points covered in that chapter. By reading through this list you should be able to reassure yourself that you have got everything out of the chapter that you can, or go back and read sections again that are not yet clear in your mind.

Flow chart

The exact process of designing an experiment will vary considerably between studies. Nevertheless, there are key stages in the design process that will apply to most, if not all, studies. The flow chart at the end of this book is intended to summarize and guide you through the main stages of designing an experiment. We have indicated at each point in the chart the sections of the book that are most relevant.