

BOOK REVIEWS

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Statistics Done Wrong: The Woefully Complete Guide by Alex Reinhart.
ISBN 9789-1-59327-620-1, 158 pages
Published by No starch press, 2015

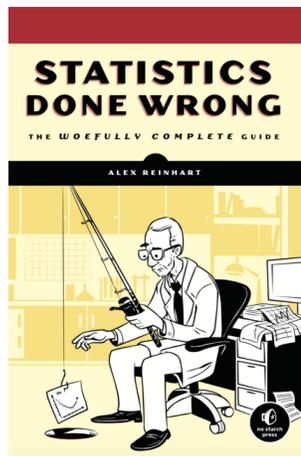
Reviewed by Robert Bilinski, Collège Montmorency.

In his graduate studies in physics, M. Reinhart discovered that unintentional statistical errors are more common than all-out fraud. Ultimately, this physicist got hooked on statistics and reoriented his career path: now his main research interest is finding models that predict where crimes occur. This book, the author's first, is the result of his newfound passion for uncovering statistical fallacies.

Statistics Done Wrong is split into 12 chapters with titles such as "Statistical Power and Underpowered Statistics", "Pseudoreplication: Choose Your Data Wisely", "The p Value and the Base Rate Fallacy", "Double Dipping in the Data". If you are unfamiliar with these terms, you should probably read this book. It will give you an idea of how to apply critical thinking to published research and recognize many possible sources of errors such as poorly planned experiments, bad data collection and errors in compilation. At the beginning, the book assumes that all the correct steps have been taken. The author then tries to answer "What is statistics as a field?", "What are the various statistics and how can they be used correctly?", "What do they mean and what do they not mean?". Later, more fundamental questions are broached: "How do you measure what you want to study?", "What answers does your data give you and does it answer the questions you asked?".

And if the titles of the chapters are familiar to you, it probably means you have done some statistical analysis, but I still recommend this book. The content will offer some interesting tidbits. The review of the possible errors is quite extensive and the variety of the examples of misuse is not only wide ranging, but also stemming from many fields. The last few chapters cover the unethical side of the research industry as well as structural flaws that encourage errors in publishing. The very last chapter offers a few guidelines on how to be more conscious and try to avoid the pitfalls in statistical research.

Books that talk about what not to do are rare whereas I feel that they should occupy a bigger place in a scientist's reading diet. It keeps the mind sharp; it is all too easy to be stuck in a rut without knowing it. Reading a book like this recharges the good "doubting of oneself and one's approach" that makes science advance in objectivity towards truth. Naturally, this book will be of much more



apparent use to an applied mathematician dealing with authentic data and modelling. However, the current overspecialization and the decrease in mathematical and statistical content in other scientific fields make it all the more important that all mathematicians and statisticians get more knowledgeable about resources like this book. One becomes wise when reading the very subtle shortcomings of others; as Socrates was quoted by Plato to have said : “The beginning of wisdom is to know that one knows nothing.” Actually, the crux of the book comes down to “even if a scientist is well meaning, he can make subtle methodological errors that make his results unusable”. As an example, let us read (p.37) the analysis of the error on “menstrual synchronization” apparently established in a 1971 *Nature* article on (M. K. McClintock (1971), “Menstrual Synchrony and Suppression”, *Nature* 229, p. 244-245):

Unfortunately, the statistical test they used assumed that if there was no synchronization, the deviation would randomly increase or decrease from one period to another. But imagine two women in the study who start with aligned cycles. One has an average gap of 28 days between periods and the other a gap of roughly 30 days. Their cycles will diverge consistently over the course of the study, starting 2 days apart, then four days, and so on, with only a bit of random variation because periods are not perfectly timed. Similarly, two women can start the study not aligned but gradually align.

This example shows us that statistical problems contain mathematics, that their solution requires problem-solving skills much like *Crux* problems, that measuring things is not particularly easy, and, moreover, as a society we have erred in lowering math standards.

Statistics Done Wrong is not all about errors; it is also about avoiding them. Each chapter ends with a brief list of do’s and don’ts that should limit the mistakes exposed in the chapter. Naturally, these lists are not exhaustive and failsafe, but they offer stepping stones to a better statistical practise.

The above example is one of many in the book. The reader will not learn statistics while reading it though. There are no formulas or graphs or even data for that matter. *Statistics Done Wrong* is a general interest book that should be read by researchers in all fields. The style and writing is fluid and enjoyable, but, as is true for all books of this level, one needs to be available mentally to fully benefit from it. It is not light reading material, but oh so necessary. If this book review entices you to read the book under scrutiny and if you find it interesting, I also recommend *Common Errors in Statistics and How to Avoid Them* published at Wiley. This second book is technical, with formulas, graphs and data. The next evolution would be statistical case study books, supposing you already have knowledge of advanced statistical techniques. If this kind of book is well written, you can have a statistical apprentice’s journey which will further your skills. *Statistics Done Wrong* has been done right. Good reading!

