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Statistics of life

Lectures on Biostatistics
by D. Colquhoun
Oxford University Press. £5.50
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It is rare indeed to be confronted by a textbook that is so beautifully written that it is sure, for the time being, to be the last word on the subject. This is the case with Colquhoun's book, which radiates wisdom in a hitherto obscure field. Its worst blemish is its title; it illustrates its statistical methods by examples in medicine, physiology and pharmacology, but it is only the applications that are special, not the statistics.

It is easy to say what is covered, but this gives little idea of the value of the book;' binomial, Poisson, normal (and Student's) distributions, variance, confidence limits, correlation and (with specific medical reference) assays and calibration curves, the individual effective dose and so on. The treatment is based on lectures to final year medical students in London and Edinburgh, so the mathematical demands are modest; what the author is after are the *ideas.*

He makes the point on the first page that the good experimenter 'needs no statistics (except in stochastic processes), but to do good experiments is difficult and much of the function of statistics "is to prevent people making fools of themselves". And, he might have added, the great virtue of this book is to prevent them making fools of themselves with statistics. No theoretical assumption is allowed to pass without a demand for justification; and in the absence of justification the assumption goes. This position, and the limited mathematics demanded from readers, combine to emphasize nonparametric estimates wherever possible.

But the style can best be judged by a section of chapter seven. The chapter' is headed by quotation that Brecht put into the mouth of Galileo, "Es ist nicht ihr Ziel [of Science], der unendlichen Weisheit eine Tür zu öffnen, sonde eine Grenze zu setzen dem unendlichen Irrtum". Then Section 7.2, which is headed "Precision of inferences. Can estimates of error be trusted?" begins "The answer is that they cannot be trusted, The reasons will now be discussed . . . ". One hears, as one reads through the book, a Johnsonian voice saying: "Sir, if you will believe that, you will believe anything!".

The treatment has, great good humour. Not only in discussing for instance the paradox that, if buses arrive *randomly* at a mean interval of 10 minutes, 'a passenger has on average to wait 10 minutes (not 5) for the next bus; the paragraph on "The black magical assay of purity in heart as an example of binomial sampling (from a paper of Oakley in UCH Magazine[1] in 1943) deserves extended notice. The 1932 experiment is described first:

"The legend of the Brocken (the famous peak in the Harz mountains noted for its 'spectre' and as the haunt of witches on Walpurgis Night), according to which a 'virgin he-goat' can be converted into a 'youth of surpassing beauty' by spells performed in a _magic circle at midnight, was tested on June 17 by British and German scientists and investigators, including Professor Joad and Mr Harry Price of the National Institute of Psychical Research. The object was to expose the fallacy of Black Magic and also to pay a tribute to Goethe, who used the legend in 'Faust'. Some wore evening dress. The goat was anointed with the prescribed compound of scrappings from church bells, bats' blood, soot and honey.

The necessary 'maiden pure in heart' who removed the white sheet 'from the goat at the critical moment, was Fraulein Urta Bohn, daughter of one of the German professors taking part in the test. Her mother was a Scotswoman (formerly Miss Gordon). The scene was floodlit and filmed. As our photographs show, the goat remained as goat, and the legend of the Brocken was dispelled!"

Oakley's analysis proceeded by estimating the purity in heart index (PHI) of a maiden by observing how many of a group of he-goats were converted. In conformity with the pharmacological situation (specified response to drug dosage), he supposed that log percentage he-goat conversion against log PHI would have sigmoid form. The author 'wisely criticizes this; it implies that the log_ PHI to convert one he-goat is a normally distributed variable, so that infinite PHI is needed to produce 100 per cent conversion rate.

So he prefers to define PHI by means of conversion percentage. Oakley recommended at least 10 he-goats as sample for a preliminary experiment. If five were observed converted this would give confidence limits (5 per cent) for the true PHI as 18 per cent to 81 per cent. "While the most extreme forms of vice and of virtue appear to be ruled out by this result. . . the most tolerant suitor might be forgiven for requiring a larger sample."

At a more technical level the expository *tour de force* is the discussion of the curve fitting for the Michaelis-Menten hyperbola (section 12_8) in biochemistry. The equation relates the velocity of an enzyme-catalysed reaction with concentration, and the parameters are not linearly related to the velocity. The experiments discussed numerically at length are not real ones, but computer-simulations, so that correct values arc known. First, the snags in least squares methods are considered, taking account of search procedures. . But the much more entertaining section is that dealing with transformations that should give a straight line, and the execrable numerical results that come from them.

The book is not only to be warmly recommended for students in its intended field. Anyone learning statistics at any level will profit by its lucidity and lack of humbug.

C.W. Kilmister

[1] Oakley's original paper was actually in the *University of Leeds Medical Journal*