which is seen in some of the early work of the fifteenth century; and his aim has been to bring out characteristics rather than finished details. Frankly, however, as to furnishing good likenesses of the men portrayed, the results are very unsatisfactory.

As a general summary, the work is a fair presentation of the claims of France, it is delightfully written, and it is worthy of careful reading by everyone of mathematical tastes. The study of the nineteenth century will be particularly helpful to the student; it is hardly intended as mathematics, but it is very well-written history.

DAVID EUGENE SMITH

SECRIST ON STATISTICAL METHODS

An Introduction to Statistical Methods, Revised Edition. By Horace Secrist. New York, The Macmillan Company, 1925. xxxiii+584 pp.

The most notable developments in mathematics have had their origins in attempts to solve difficult practical problems. The purpose of mathematics is not to make easy things hard but to make hard things easy. If it sometimes seems to the layman that the former is true, this is because, with the powerful tools at hand, the mathematician frequently undertakes difficult things. The association between mathematics and difficulty is so close that the illusion is created that there is a necessary connection, and that, to avoid difficulty, one must at all costs avoid mathematics. This illusion is rather common among the economic-business group of statisticians.

There is a large section of Secrist's book which contains no mathematics, and there is no objection to its exclusion from this portion, for here the ideas portrayed are so simple that they can be conveyed easily by pictures and numerical illustrations. This part, perhaps seventy-five per cent, is intended for the use of those who have not studied, or at least are not still accustomed to the use of high school algebra. So far as the reviewer is qualified to pass on this phase of the work, it appears to be a valuable contribution. It is fair to say that it does not possess distinct literary merit or marked individuality of approach. The author is rather over fond of quotation. Especially when some difficult point is to be explained, or a critical remark to be made, it is usually somebody else who is invoked to do it; so that at times it almost seems that we have a compendium of what various authorities have said, Fisher, Bowley, Mitchell, et al., and sometimes Pearson and Pearl, but nevertheless a very useful one, handy as a reference book—notably Chapter XVI on indexes—up to date, and easy to read.

The other and newer part of the book deals with more difficult ideas. Rightly again, in view of the type of student for which the book was written, only the simplest of these are presented; but now it would seem to have been better for the author to have demanded a minimum of mathematics, certainly some algebra, and probably some analytics. In fact, at times he seems to be forced into presupposing these subjects, inconsistently with his general attitude. On page 425, for example, he assumes that the student understands what is meant by the mathematical "slope" of a line, but on page 427 he gives a detailed explanation (by an inconvenient method) of how one plots a line. In general, however, no real mathematics is presupposed, and the result is a laboriousness of explanation which can hardly produce in the mind of the reader more than a rough approximation to understanding.

This deliberate avoidance of mathematics is so common in statistical literature that it is worth while noting some illustrations of it here. It requires a good deal of argumentation, if one is unwilling to use algebra, to convince a student that a change of base can be made by forming proportions between certain kinds of index numbers, but not between certain other kinds. But the essential point is only this:

$$\frac{a}{b}+\frac{c}{d}\neq 2\cdot\frac{a+c}{b+d}\,,\quad \text{usually, but}\quad \frac{a}{b}\cdot\frac{c}{d}=\frac{ac}{bd}\,.$$

These algebraic statements surely have a meaning for the bright high school boy, and they are the crux of the whole matter; therefore to omit them is to becloud with argument what is really very simple and already well known. On page 279 there is an example of "some do's and don'ts." This one is a don't. Again, it might be stated in the absurdly simple form of the first inequality just given above, and then it might be illustrated. Thus one would not have to learn it; one would understand it, and that would be sufficient. But, instead, no explanation whatever is given; we are asked to learn that the method leads to an incorrect result, and, if we ask why, we are led to suppose that it just happens that way, or perhaps it is paradoxical.*

The author thus refuses a searching analysis to his readers. Also, there are occasional paragraphs where his own thought does not seem to have been sufficiently clear and thorough. One such paragraph is on page 373, ending "Hence, the reliability of a sample may be expressed in terms of its probable error." Another instance is his discussion of "significance." "It is said conventionally (p. 370) that if a certain result is three or more times as large as its probable error it is 'significant'." At best this is not a carefully stated definition. Suppose the coefficient of correlation between two characters in a population were truly zero. This definition would *imply* that it would not be possible to get a reliable estimate of this coefficient by sampling from the population. "What is meant by this expression? (p. 371)—"that the odds against the appearance" of the measurement in question, (p. 372), are about 1 in 22. This statement is not a correctly stated deduction; the odds against the appearance of this measurement are infinite; the odds are about 1 in 22 against the appearance of a measure-

* Expecially because there is a reference at this point to a paper by the author on *A statistical paradox*, which is in fact only an illustration of another rather simple algebraic inequality.

ment differing from the true value by as much as three times its probable error. On page 429 there is another definition of significance, also "what it has become conventional to say." Six times the probable error is now demanded. It is not explained why the conventional practice is now different, although the difference in meaning is very great: odds of 1:22 in the one case and 1:19,200 in the other. Secrist writes exactly as if he had never heard of a genuine probability distribution which was skew. To him "pure chance" seems to mean always a normal distribution (p. 399), otherwise there is "bias" and anything may happen. On page 376 we further read that the normal is the probability distribution approached in the measurement of natural and physical phenomena "which logic and belief (*sic*) prompt us to expect." We do not understand what is in his mind here.

The book is well nigh perfect in technique, quite free from typographical errors, well printed on good paper, and well bound. Compared with the earlier edition (1917) of which it is a revision, it is "enlarged, simplified, rearranged, and more fully illustrated. New chapters on *The Theory of Probability and Some Properties of the Normal Law of Error Distribution*, and on *The Treatment and Correlation of Time Series* have been added. Those relating to *The Principles of Index Number Making and Using*, and *American Index Numbers Described and Compared*, have been entirely recast." An appendix, with tables, has been added. The book contains a very great deal of useful information, gathered from reliable sources and well indexed.

B. H. CAMP