

Philosophical foundations of Statistics

Van Aarde, Mauritz. 2009. **The epistemology of statistical science.** Stellenbosch: Sun Press. 446 p. Price: R380,00.
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Reviewer: J.C. Geertsema
Faculty of Natural Sciences
Potchefstroom Campus, North-West University

This book is intended to be a contribution to the debate on the philosophical foundations of Statistics, a debate which has continued for more than a century and with many conflicting views. It has been said that the subject of Statistics suffers such strong divisions concerning its foundations because it is so close to the philosophy of knowledge. Indeed, Statistics is concerned with the very difficult and age old problem of obtaining valid knowledge from numerical data. The author has strong ideas about this and chose the subtitle "Challenging the statistical profession" for his Epilogue, in which he pleads for understanding if he appears to be "overly aggressive, even arrogant". His motivation for his strong approach is the perceived prejudices from fellow statisticians he needs to overcome, the alleged detrimental influence of authority in the subject and his fear of damage done to the "substantive sciences" through present statistical theory and practice.

The intended readership for the book is the members of the statistical profession, but even among these, it will be mainly those with some maturity in the understanding of statistical theory and practice who will benefit from a close reading of this material. Others, including people with an interest in the philosophical foundations of science, could form an impression of some of the main issues in the foundational debate by reading some of the less technical parts of the book. Even so, the book is not easy reading material. The arguments are developed slowly and the insertion of many detailed examples to motivate and illustrate the ideas often obscures the progress in the argumentation. The absence of an alphabetical index of topics creates another obstacle.

The author begins the book by stating his view that statistical data analysis concerns the development of statistical models for the representation of numerical data and that there is then a need for methods to test the adequacy of such models. In this connection, he emphasises his view that Statistics has an investigative character as contradictory to the widely accepted view that its aim is decision-making. To him the question is how a given set of data might have come about whereafter a suitable test would be able to separate more tenable explanations from less tenable ones. This is a question of determining the quality of fit. He disagrees with the theories of testing which were introduced during the previous century and proceeds to develop a new kind of test. The test is named a “co-ordination test”, since it is expressed in terms of so-called “co-ordinates”. It has a close relationship with “significance tests” as originally developed by R.A. Fisher, one of the main figures in early twentieth century statistics.

In most of the remainder of the book, and in separate chapters, the author contrasts his own ideas with other established schools of thought, namely decision-making under risk, frequentist inference, significance tests, likelihood inference, Bayesian inference and Fisher's fiducial inference. These chapters are of independent interest, since they provide a new and detailed discussion with examples which illustrate many of the arguments from the relevant literature on these topics. Unfortunately there are no references to important books on the comparison of statistical schools of thought, such as those by Barnett and by Berger.

The book takes a strong empiricist stand against logic and rationalism. There is an emphasis on the importance and the leading position of what is named the substantive sciences, which we must understand to be the empirical sciences. In the Preface and

elsewhere, there are arguments that Statistics is a science like these sciences, differing only in its subject matter and that Statistics must learn from them how to reason. Similarly, it is argued that there is no need for the term *statistical inference*, since the other sciences would then need to have their own inferences as well. In reaction to this approach, one may ask whether this is a good understanding of the unique place of Statistics among the sciences. A more widely accepted view is that Statistics has as aim the establishing of a systematic and common methodology for the analysis of numerical data which arise through observation and experiment in the empirical sciences. In this way Statistics serves these sciences through statistical inference which refines and contributes to the hypothetico-deductive scientific method used by them.

In conclusion, the book may be recommended to those who have an interest in the philosophical foundations of Statistics and its relationship to the empirical sciences. Readers will have to keep in mind that this is highly polemical material with an intended new approach to the continuing debate in this area. Time will tell what the level of acceptance of these ideas will be.