Statistical Inference as Severe Testing

How to Get Beyond the Statistics Wars

Mounting failures of replication in the social and biological sciences give a new urgency to critically appraising proposed reforms. This book pulls back the cover on disagreements between experts charged with restoring integrity to science. It denies two pervasive views of the role of probability in inference: to assign degrees of belief, and to control error rates in a long run. If statistical consumers are unaware of assumptions behind rival evidence reforms, they can't scrutinize the consequences that affect them (in personalized medicine, psychology, and so on). The book sets sail with a simple tool: If little has been done to rule out flaws in inferring a claim, then it has not passed a severe test. Many methods advocated by data experts do not stand up to severe scrutiny, and are even in tension with successful strategies for blocking or accounting for cherry picking and selective reporting. Through a series of excursions, tours, and exhibits, the philosophy and history of inductive inference come alive, while philosophical tools are put to work to solve problems about science and pseudoscience, induction and falsification.

Deborah G. Mayo is Professor Emerita in the Department of Philosophy at Virginia Tech and is a visiting professor at the London School of Economics and Political Science, Centre for the Philosophy of Natural and Social Science. She is the author of *Error and the Growth of Experimental Knowledge* (1996), which won the 1998 Lakatos Prize awarded to the most outstanding contribution to the philosophy of science during the previous six years. She co-edited *Error and Inference: Recent Exchanges on Experimental Reasoning, Reliability, and the Objectivity and Rationality of Science* (2010, Cambridge University Press) with Aris Spanos, and has published widely in the philosophy of science, statistics, and experimental inference.

"In this lively, witty, and intellectually engaging book, Deborah Mayo returns to first principles to make sense of statistics. She takes us beyond statistical formalism and recipes, and asks us to think philosophically about the enterprise of statistical inference itself. Her contribution will be a welcomed addition to statistical learning. Mayo's timely book will shrink enlarged posteriors and overinflated significance, by focusing on whether our inferences have been severely tested, which is where we should be focused."

– Nathan A. Schachtman, Lecturer in Law, Columbia Law School

"Whether or not you agree with her basic stance on statistical inference, if you are interested in the subject – and all scientists ought to be – Deborah Mayo's writings are a must. Her views on inference are all the more valuable for being contrary to much current consensus. Her latest book will delight many and infuriate others but force all who are serious about these issues to think. Her capacity to jolt the complacent is second to none."

– Stephen Senn, author of *Dicing with Death*

"Deborah Mayo's insights into the philosophical dimensions of these problems are unsurpassed in their originality, their importance, and the breadth of understanding on which they are based. Here she combines perspectives from philosophy of science and the foundations of statistics to eliminate mirages produced by misunderstandings both philosophical and statistical, while putting into focus the ways in which her error-statistical approach is relevant to current problems of scientific inquiry in various disciplines."

– Kent Staley, Saint Louis University

"This book by Deborah Mayo is a timely examination of the use of statistics in science. Her severity requirement demands that the scientist provide a sharp question and related data. Absent that, the observer should withhold judgment or outright reject. It is time to get tough. Funding agencies should take note."

– S. Stanley Young, Ph.D., FASA FAAAS

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