Inference and Disputed Authorship: The Federalist. By Frederick Mosteller and David L. Wallace (Reading, Addison-Wesley, 1964) 364 pp. $12.50

The Federalist papers, published in 1787–1788, were written by Alexander Hamilton, John Jay, and James Madison, under the pseudonym "Publius," to persuade the citizens of New York State to ratify the Constitution. A total of seventy-seven essays appeared in newspapers such as *The Independent Journal* and *The New-York Packet*, and, although the authors chose to write anonymously, "it is generally agreed that Jay wrote five: Nos. 2, 3, 4, 5, and 64, leaving no further problem about Jay's share. Hamilton is identified as the author of forty-three papers, Madison of fourteen. The authorship of twelve papers (Nos. 49–58, 62, and 63) is in dispute between Hamilton and Madison; finally, there are also three joint papers, Nos. 18, 19, and 20, where the issue is the extent of each man's contribution."[1]

The present book, written by two statisticians, attempts to present statistical methodology which reduces the uncertainty surrounding the authorship of the twelve disputed *Federalist* papers by comparing their properties with those of papers of known authorship. Mosteller and Wallace begin with a review of the controversy surrounding the disputed papers, and briefly discuss an earlier unpublished attempt by Frederick Williams and Mosteller, in 1941, to resolve the controversy by the use of sentence lengths (i.e., the number of words per sentence). Although these original investigations were inconclusive at best, they led to the present studies by Mosteller and Wallace.

It might ordinarily be considered somewhat unusual for a review of a book, such as the one by Mosteller and Wallace, to appear in a new journal seven full years after the book's publication. Since the present book has received little or no attention from historians, despite its methodological and historical importance, the purpose of this review is to bring it to the attention of qualitative historians. Few historians have heard of this work, and only a small number of these possess the requisite statistical skills to embark on the formidable task of reading the book. The purpose of the present review is to introduce the work of Mosteller and Wallace to an entirely new audience.

At this stage, it is important to note that the reviewer is a statistician, not a historian. It is difficult for me, as a statistician, to suppress my

1 Frederick Mosteller and David L. Wallace, "Inference in an Authorship Problem," *Journal of the American Statistical Association*, LVIII (1963), 275–309.

admiration for the manner in which the authors go about resolving the problem at hand. When asked to give statistical advice on the analysis of a particular set of data, the statistician will all too often refer the investigator, who in this case might be a historian, to one of several statistical text books that describe a technique which the statistician thinks may be applicable to the investigator's data. Only in rare circumstances does the statistician throw himself completely into the problem using a wide variety of statistical techniques to explore all of the nuances of the data. This book presents a description of just such a circumstance, and describes, from start to finish, the way in which two eminent statisticians have "solved" the particular problem of disputed authorship.

The analysis used to assess the authorship of the disputed papers is more involved than one might first believe, mainly because the basic data consist of seventy-seven papers, ranging from 900 to 3,600 words in length. After a considerable amount of data analysis and several screening studies, the authors decided upon using, as the basic units for the ultimate statistical analyses, the rate of occurrence for a series of non-contextual words such as "upon" and "enough," in addition to *function words* such as "by," "of," and "to." This type of data reduction, if and when it takes place in applied statistical books, is almost never reported in detail.

In dealing with a specific problem of historical and literary interest, Mosteller and Wallace have, in reality, written a textbook on the practical and theoretical aspects of a large-scale statistical analysis of data. After introducing the problem and the data in Chapters 1 and 2, they proceed with four parallel studies, each of which utilizes a somewhat different statistical methodology. The book is arranged in such a manner that the bulk of the statistical theory, most of which is used in the first of the four parallel studies, is collected in one chapter (which, however, constitutes over one third of the text).

As the reader may gather, the book is not intended for the statistical novice; yet someone with one or two basic courses in statistics should find all but the "theoretical chapter" and possibly Chapter 6 easy to understand. The reader with a year's training in theoretical statistics is likely to follow most of the mathematical discussion, although he will require some perseverance. Finally the applied statistician will find a description of techniques in this book which is not available in any other source.

What makes this book unique from a statistical point of view is its

heavy use of "Bayesian" methods. Bayes' Theorem, upon which such methods are based, is an elementary theorem of probability theory found in almost all introductory statistical text books. Although first proposed in a special case by the Reverend Thomas Bayes in 1764, the theorem has only recently been used by large numbers of statisticians as the basis of statistical inference. The present volume by Mosteller and Wallace contains the first published example of a large-scale Bayesian study. Indeed, at least two of the four studies in this book could be said to be Bayesian in their approach.

Balancing these Bayesian analyses are separate studies making use of the classical statistical techniques of linear discrimination. In these studies, the authors construct a weighted sum of the rates for several words on the basis of the data from one half of the papers of known authorship. This function is then tested on the remaining material of known authorship for calibration purposes. This calibration process, referred to elsewhere as cross-validation, provides estimates of the variability for the weights in the discriminant function. Finally, the linear discriminant is applied to the twelve disputed papers, and the values obtained are sorted on the basis of the information gleaned from the calibration process. The description provided by Mosteller and Wallace is straightforward and informative, and the analysis presented here will ultimately find its way into statistical text books.

Lest the reader conclude that no further statistical analysis of the disputed authorship question might be worthwhile, let him note that, after the publication of the present volume, Mosteller and John Tukey[2] carried out yet another study of *The Federalist* papers, using linear discrimination and the newly developed technique of "jackknifing". The Mosteller-Tukey analysis provides a highly useful supplement to the present work.

Within the historical profession, there is a movement to develop an approach to history which has been termed scientific historiography. Such an approach must be based upon, among other things, the quantification of historical problems and their analysis by a wide variety of statistical techniques. The ability of the historian to bring the effects of a large number of variables to bear simultaneously on the resolution of certain problems will undoubtedly play an important role in the advancement of this quantitative approach to history. Several techniques

2 Frederick Mosteller and John W. Tukey, "Data Analysis, Including Statistics," in Gardner Lindzey and Elliot Aronson (eds.), *Handbook of Social Psychology* (Reading, 1968; rev. ed.), 80–203.

such as linear discriminant analysis, which is presented in the Mosteller and Wallace book, are designed to deal with the question of identifying individuals as members of particular groups, given that the characteristics of membership samples from these groups are known. Since questions of group membership arise in a wide variety of historical studies, these techniques should prove invaluable to the quantitative historian. A related historical problem deals with the identification of groups of individuals or objects, when the researcher has no advance knowledge concerning the membership characteristics of these groups. In the context of legislative voting behavior, such problem have been recently discussed by MacRae.[3]

In conclusion, let me strongly recommend this book to all readers who are interested in learning the ideal way to approach the statistical analysis of data. In the short time since its publication this volume has come to be considered a classic by both theoretical and applied statisticians. In addition, I wish to encourage those historians concerned with authorship problems to take advantage of the statistical methods presented in this model study.

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Land of Many Frontiers: A History of the American Southwest. By Odie B. Faulk (New York, Oxford University Press, 1968) 358 pp. $7.50

Faulk's *Land of Many Frontiers*, a "general history" based on secondary sources, chronicles most of the familiar episodes of the American Southwest. From its Spanish origins to its current state, the author presents a survey of the region arching southeast from Santa Barbara to Corpus Christi. While offering the historian little original material, Faulk does present topics worthy of further research.

The author begins his survey with an extensive coverage of the Spanish exploration, conquest, and administration of the region. This traditional approach to the period, especially the preoccupation with the Spanish search for riches—which also involves tracing the footsteps of numerous monks, the number of missions constructed, and their successes in converting the Indians—neglects the social, cultural, and economic development of the region. For example, would not a study of

3 Duncan MacRae, Jr., *Issues and Parties in Legislative Voting* (New York, 1970).