

# Scheffé, Henry | Encyclopedia.com

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(b. [New York](#) City, II April 1907; d. Berkeley, California, 5 July 1977)

*mathematics, statistics.*

Scheffé was born of German parents living in [New York](#). His father, who had for many years worked as a baker, lost his job during the Depression and was reduced to selling apples at a street corner. The memory of this injustice and of his father's suffering remained with Scheffé throughout his life.

Following some preliminary training and work in engineering, Scheffé studied mathematics at the [University of Wisconsin](#), where he obtained his B. A. in 1931 and his Ph.D. in 1935 with a thesis on differential equations, written under R. E. Langer. After teaching mathematics at Wisconsin (1935-1937), Oregon State University (1937-1939, 1941), and Reed College (1939-1940), he decided to switch from pure mathematics to statistics, and for this purpose in 1941 joined the statistics group assembled by S. S. Wilks at Princeton. As a statistician he taught at Syracuse (1944-1945), U.C.L.A. (1946-1948), and Columbia (1948-1953), and then went to Berkeley as professor of statistics and assistant director of the Statistical Laboratory. Although he soon resigned from his administrative position, he remained in Berkeley until his retirement in 1974. At both Columbia and Berkeley he chaired the statistics department for a number of years.

Scheffé was elected fellow of the Institute of Mathematical Statistics (1944), the American Statistical Association (1952), and the International Statistical Institute (1964). He also served as president of the IMS and vice president of the ASA.

Throughout his life Scheffé enjoyed reading, music (as an adult he learned to play the recorder), and traveling. He was also physically active. At Wisconsin he was an intercollegiate wrestler, and he liked to bicycle, swim, and backpack with his family. (In 1934 he had married Miriam Kott and they had two children. Miriam and Michael.)

As he came to statistics from mathematics, it was natural for Scheffé to become interested in the more mathematical aspects of statistical theory, particularly in optimality properties of statistical procedures. In a series of papers (1942-1955) he supplemented and extended the Neyman-Pearson theory of best similar test, and eventually in joint work with Lehmann developed a general theory containing many of the earlier results as special cases. The central concepts of this approach were those of sufficiency and completeness, which led to a characterization of all similar tests (and all unbiased estimates) when the minimal sufficient statistics are complete.

Scheffé's interest in more applied aspects of statistics grew out of, and was constantly fed by, consulting activities. From 1943 to 1946 he worked as consultant and senior mathematics officer at the Office of Scientific Research and Development under a contract with [Princeton University](#). Later, he became a consultant for Consumers' Union and Standard Oil. Nearly all of Scheffé's research during the second phase of his career, which started in the early 1950's, was concerned with various aspects of linear models, particularly the analysis of variance. By adapting the theory to new situations, he significantly extended its range of applicability. Throughout, this work is characterized by a combination of the mathematical and applied points of view. He insists on clearly defined mathematical models. However, these are not formulated on the basis of mathematical convenience but are carefully grounded in the process generating the observations.

Perhaps the most important of Scheffé's papers from this period is the 1953 paper in which he develops his S-method of simultaneous confidence intervals for all contrasts (and more generally for all estimable functions in a linear subspace of the parameter space), which permits the testing and estimation of contrasts suggested by the data. While this work had forerunners in Tukey's *T*-method (and, though not known to Scheffé at the time, in the much earlier work of H. Working and H. Hotelling [1929]), this was the first general procedure, applicable to all linear models. It is an extremely elegant solution of a fundamental problem of statistical practice. That it is the only solution exhibiting certain desirable symmetry properties was shown by Wijsman (1979).

Among other analysis of variance topics treated in this rigorous yet practice-oriented way are paired comparisons with ordered categorical response (1952), mixed models (1956), experiments on mixtures (1958, 1963), and some aspects of calibration (1973). Of these, the work on mixtures initiated a new methodology, which since then has developed a substantial literature.

Scheffé's research extended into his expository writing. In 1943 he published the first comprehensive review of nonparametric statistics, which laid a foundation for the explosive development of this field during the next two decades. His most influential work, however, was his book *The Analysis of Variance* (1959). Its careful exposition of the different principal models, their

analyses, and the performance of the procedures when the model assumptions do not hold is exemplary, and the book continues to be a standard text and reference. Scheffé hoped to revise it after retirement. However, a few weeks after returning to Berkeley from a three-year post-retirement position at the University of Indiana, while still in the midst of the revision, he died as the result of a bicycle accident.

## **BIBLIOGRAPHY**

A complete list of Scheffé's publications is given at the end of the obituary by C. Daniel and E. L. Lehmann in *Annals of Statistics*, **7** (1979), 1149-1161. Optimality of Scheffé's S-method was proved by Robert A. Wijsman in "Constructing All Smallest Simultaneous Confidence Sets in a Given Class, with Applications to MANOVA". *ibid.*, 1003-1018. The mixture designs introduced by Scheffé constitute the foundation of the later theory, an account of which is provided by John A. Cornell. *Experiments with Mixtures* (New York, 1981).

Erich Lehmann