

Gertrude Mary COX

b. 13 January 1900 - d. 17 October 1978

Summary. Gertrude Cox is principally known as a gifted statistical administrator and entrepreneur, as well as for her contributions to psychological statistics and experimental design.

Gertrude Cox was born on a farm near Dayton, Iowa, USA. The family soon moved to the small town of Perry, Iowa, where she attended public school. Cox was particularly close to her mother, Emma, and later wrote of her: "I learned from my mother the value and joy of doing for other people. She nursed the sick for miles around and raised us to be active church workers".

Gertrude Cox's ambition was to help others. She took a two-year course in social science, then spent another two years as a housemother for sixteen small orphan boys in Montana. As preparation for becoming the superintendent of the orphanage, she decided to enroll at Iowa State College. Majoring in mathematics, because it was easy for her, she elected courses in psychology, sociology, and crafts - courses useful to her in her chosen career. In 1929 she received her B.S degree.

To help pay her college expenses Cox did computing. George Snedecor (q.v.) - her calculus professor - having asked her to work with the comptometers in his computing laboratory. Perhaps because of this computing experience, Cox became interested in statistics. But the Mathematics Department at that time would not award an assistantship to a woman, and she financed her graduate work with assistantships in psychology and art. In 1931, she received the first Master's degree ever given by Iowa State in statistics but was turned down for a job teaching high school mathematics because she did not have the required courses in education. She decided to continue her graduate career.

Because of her love of people and her desire to learn what "made them tick", Cox chose psychology as her research area. With a graduate assistantship at the University of California, Berkeley, she began work on a doctorate in psychological statistics. But she stayed only two years. In 1933, Iowa State established its Statistical Laboratory under the direction of George Snedecor, Cox's former mentor, and he persuaded her to return home to help him. Back in Iowa, she continued her interest in psychology and worked on the evaluation of aptitude tests, test scoring procedures, and

the analysis of psychological data.

At the same time, she was put in charge of establishing a Computing Laboratory and consulted in and taught experimental designs. In 1934 she began to teach 'Design of Experiments' - a course that would become renowned - to follow Snedecor's 'Statistical Methods'. Both courses were originally taught from mimeographed materials. In 1937, Snedecor's material came out in book form, but Cox only published her design material in 1950, when it came out as a collaborative effort with W.G. Cochran.

Gertrude Cox's course was built around a multitude of specific examples in a variety of areas of experimentation. Both as a teacher and as a consultant she particularly emphasized randomization, replication and experimental controls as procedures essential to experimental design.

Though Gertrude Cox was enrolled in a PhD program in mathematics at Iowa State, her teaching and consulting duties did not leave her enough time to write a dissertation. An 'assistant' from 1933, she was appointed research assistant professor in 1939, though her design course was listed under Professor Snedecor's name.

In 1940 Snedecor was asked to recommend candidates to head the new Department of Experimental Statistics in the School of Agriculture at North Carolina State College. "Why didn't you put my name on the list?" Cox asked when he showed her his all-male list of candidates, and her name was added to the accompanying letter in the following postscript: "If you would consider a woman for this position, I would recommend Gertrude Cox of my staff." This terse note was to have far-reaching consequences for statistics, for not only was Cox considered, she was selected.

Gertrude Cox became the head of North Carolina State's Department of Experimental Statistics on November 1, 1940. She recruited capable applied statisticians to teach basic statistical methods and she made them available to consult with researchers on procedures for designing experiments and analysing data. To secure at least one faculty member for every agricultural discipline, she had to start from scratch. "There weren't any statisticians to hire when I first started", she later wrote. "I had to choose from other fields and train them."

Another innovative feature of the Cox statistics program was a series of one-week working conferences on specific topics. In addition to experimental and mathematical statistics, these conferences covered many research areas involving statistics. Many were held during World War II. Cox, realizing the importance of quality control methods to the war effort, included engineering

statisticians on the faculty.

Gertrude Cox was uniquely able to secure outside financial support. In 1944 she obtained a grant from the General Education Board to establish and direct an Institute of Statistics. This grant enabled her to add six faculty members to her department, including W.G. Cochran, who was to develop a graduate program. In 1945, the General Education Board made an additional grant to establish a Consolidated University of North Carolina Institute of Statistics, with a Department of Mathematical Statistics at Chapel Hill, to concentrate on graduate training and research in statistical theory. With complimentary graduate programs, the two departments produced many outstanding applied and theoretical statisticians. Cox also persuaded the Rockefeller Foundation to support a substantial program in statistical genetics and she obtained funds from the Ford Foundation for a joint program in dynamic economics with the London School of Economics.

Cox's first contact with statistics came in the computing laboratory, and she remained a strong advocate of the integral connection between statistical analysis and an up-to-date computing facility. She made certain that the Institute was in the forefront when it came to statistical software, and Raleigh statisticians designed the initial SAS programs.

Gertrude Cox and seven other members of the North Carolina State statistics faculty arranged for a Statistical Division as part of in the proposed not-for-profit Research Triangle Institute (RTI) between Raleigh and Chapel Hill. RTI was established in 1959 and Cox retired from North Carolina State in 1960 to direct its Statistics Research Division. During her five-year tenure, RTI - and especially the Statistics Division - became an internationally recognized consulting and research organization.

Gertrude Cox's major contribution to science was her ability to organize and administer programs, but her early accomplishments in psychological statistics and experimental design were widely recognized.

Cox was a founding member of the International Biometric Society in 1947, served as editor of its journal, *Biometrics*, from 1947 to 1955, and was president from 1968 to 1969. She was president of the American Statistical Association (ASA) in 1956.

In 1959 Cox received the highest recognition the Consolidated University of North Carolina can confer upon its faculty - the O. Max Gardner Award. The citation named her a 'statistical frontierswoman'. In 1970, North Carolina State honored her by designating the building in which the Statistics Department is located Cox Hall. Her most treasured honor came in 1975,

when she was elected to the National Academy of Science.

Cox was a world traveller who particularly enjoyed working in developing countries wherr she could offer advice and inspiration. Egypt and Thailand were particular favourites.

Gertrude Cox loved people, especially children. She always brought back gifts from her travels and was especially generous at Christmas time. She considered the faculty members and their families to be her family and entertained them frequently.

In 1976, Cox learned that she had leukemia but remained sure that she could conquer it up to the end. While under treatment at Duke University Hospital she kept detailed records of her progress. With characteristic testy humor she called herself “the experimental unit”, and died as she had lived, fighting to the end.

References

- [1] Anderson, R.L. (1990). Gertrude Mary Cox 1900-1978, *Biographical Memoirs, National Academy of Sciences*, **59**, 116-132.
- [2] Anderson, R.L., Monroe, R.J. and Nelson, L.A. (1979). Gertrude Cox - a modern pioneer in statistics, *Biometrics*, **35**, 3-7.

R.L. Anderson