George Elmer Forsythe

Born January 8, 1917, State College, Pa.; died April 9, 1972, Stanford, Calif..; numerical analyst and early inspiring teacher of computing who transformed Hamming's famous aphorism into "The Purpose of Computing Numbers Is Not Yet in Sight."

Education: BS, mathematics, Swarthmore College, 1937; PhD, mathematics, Brown University, 1941.

Professional Experience: Stanford junior University: instructor, mathematics, 1941, professor, mathematics, 1957-1972; meteorologist, US Air Force, 1941-1946; Boeing Aircraft Company, 1947; Institute for Numerical Analysis, University of California at Los Angeles, 1948-1957.

Honors and Awards: president, ACM, 1964-1966; ACM Distinguished Service Award, 1972; fellow, British Computer Society; ACM named its own award for student papers in memoriam to Forsythe.

Forsythe was born on January 8, 1917, in State College, Pa., and moved as a small boy with his family to Ann Arbor, Mich. His undergraduate work was at Swarthmore College, where he majored in mathematics. His experience there had a strong influence on his life. An even earlier interest in computing is described in a biographical note in *The Mathematical Sciences* (MIT Press, 1969), p. 152:

His interest in computing began early, when as a seventh-grader he tried using a hand-cranked desk calculator to find the decimal expansion of 10000/7699. He wanted to see how the digits repeated.

In 1941 Forsythe's first year as a Stanford mathematics instructor was interrupted by service in the Air Force, in which he became a meteorologist and coauthor of an outstanding book on meteorology. His interest in his students and in education had manifested itself very early. After his service in the Air Force, his interest in numerical mathematics and computation developed rapidly. He spent a year at Boeing Aircraft Corp., where he introduced what may have been the first use of automatic computing in that company: inspired by W. J. Eckert's book, *Punched Card Methods in Scientific Computation*, he had a tabulating machine set up for scientific data processing. Then he spent several years in the Institute for Numerical Analysis of the National Bureau of Standards, a special section located on the campus of the University of California, Los Angeles. He joined the institute because he wanted to watch the development of the Standards Western Automatic Computer (SWAC), one of the first of the digital computers. He had many interesting tales to tell of these early days in computing.

When I (John Herriot) thought about getting involved with numerical mathematics and computers at the time that Stanford was acquiring its first computer, it was only natural that I should consult Forsythe, who was already a leading figure in the field. His advice, or rather his analysis of the pros and cons, demonstrated his great vision. The only chance I have had to lay claim to similar astuteness was when, as chairman of a search committee, I recommended that we invite Forsythe to join the Stanford Mathematics Department. He accepted

our invitation, rejoining our department, this time as professor, in 1957. Forsythe and I worked together during these years developing the nucleus of courses in computer science. He quickly saw the need for more activity in numerical mathematics and computing. His leadership was inspiring and persuasive. He saw the computer revolution developing, and recognized the need for more study, research, and teaching in the computer area. He conceived of it as related to but still different from the traditional emphasis in mathematics; thus, he was convinced of the need for adding to the faculty scholars well versed in this area. Under his leadership, the Computer Science Division of the Mathematics Department was formed in 1961, and we began the slow process of gathering an outstanding group of colleagues.

The culmination of this effort was the founding of the Computer Science Department, one of the first such departments in the US, on January 1, 1965. As the result of his dynamic leadership and foresight, the department developed into one of the nation's outstanding computer science departments. Forsythe was very skillful in bringing together our many diverse points of view. He captured the loyalty of all of his colleagues. He had a sense of responsibility to others and to the institutions he chose to serve. It was a principle of his life that people were not instruments to be manipulated toward some end. In each of his positions of leadership, but particularly in his position as department chairman, he felt that the threads of many people's lives, and of their productive work and aspirations, ran through his hands, and that each of these must be worried about and cared for in the proper way. Carefulness, thoughtfulness, energy, attention to detail, a determination not to pass the buck-these give some of the dimensions of his sense of responsibility. He was a master at resolving differences between people with opposing views. In the closing days of his life he passed the remaining threads of responsibility, not in a tangle but in good order, to his colleagues, with thought for the lives and careers of others.

He had high standards and delighted in excellence. He expected everyone to do his best. He did not seek acclaim for his own work, but he sought it for the deserving work of others. Students' progress and development were his constant concern; perhaps the most visible and enduring evidence of his influence on other people is to be seen in the significant contributions that have been made and are being made by the students whose research he guided. He chose problems wisely and was never too busy to see and encourage his students. He instilled in them such a fine feeling for the techniques of research that most of them have continued work in important areas. The influence of his students on the direction of research in numerical analysis and on the development of computer science has been remarkable.

He was especially concerned with the welfare of students. In any discussion with his colleagues, he was a strong advocate of what he felt would. most benefit students. Forsythe's rapport with our students has perhaps been best described by one of them, Mark Smith, in his tribute at the memorial service for Forsythe. Among other things, he said:

Forsythe and I got to know each other when I was a graduate student in the department. It was two years ago during the student strike on the Stanford campus. I was active in the protests, and Forsythe, as chairman, was very concerned about what was going on. We used to meet together every afternoon to discuss the campus situation. And if someone had wandered by and peeked through the window he would have seen me with my arms flailing, pacing back and forth, and he would have seen Forsythe sitting back in his chair, calm and alert.

Forsythe brought his clear mind to bear on everything we talked about, and always found some new and reasonable way to see problems that I had thought were insoluble. But what most impressed me was not so much the clarity of Forsythe's thinking, but the feelings that lay in back of that thinking. Forsythe cared. Every day I would leave our meeting a little more amazed by the gentleness and humanity of this man.

Besides his untiring service to many organizations in various capacities, Forsythe served a term as president of the Association for Computing Machinery from 1964 to 1966. His letters to the members published in *Communications of the ACM* during those two years discuss many of his views on computer science as well as ACM business.

He always enjoyed an active life, continuing to play tennis until a few weeks before his death. He was also a jogger and a hiker and he loved the out-of-doors. His wife Sandra shared his interest in computation and his early experiences in using SWAG While Forsythe was developing computer science education at the college level, Sandra was actively pioneering this area at the high school level. Together they enjoyed traveling in many countries and hiking in the High Sierras.

All of the lives which have been touched by Forsythe have been affected in a meaningful way. We are all in his debt for his wise counsel, his friendly encouragement, and his inspiring leadership. We will continue to build on the foundation he so carefully constructed.[1]

QUOTATIONS

"The Purpose of Computing Numbers Is Not Yet in Sight.[2]

"In the past 15 years, many numerical analysts have progressed from being queer people in mathematics departments to being queer people in computer science departments!" (Knuth 1972)

About Forsythe: "One might almost regard him as the Martin Luther of the Computer Revolution." (Knuth 1972)

BIBLIOGRAPHY

Biographical

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[1] Based on Herriot 1972.

[2] A parody of Richard Hamming's dedication to his book-"The purpose of computing is insight, not numbers."

Herriot, John G., "In Memory of George E. Forsythe," *Comm. ACM,* Vol. 15, No. 8, Aug. 1972, pp. 719-720.

Knuth, Donald E., "George Forsythe and the Development of Computer Science," *Comm. ACM*, Vol. 15, No. 8, Aug. 1972, pp. 721-726.

Varah, J., "The Influence of George Forsythe and His Students," in Nash, Stephen G., *A History of Scientific Computing,* ACM Press History Series, ACM, New York, 1990.

Significant Publications

A complete list of Forsythe's publications-four books and 83 articles-is contained in Knuth 1972.

UPDATES