Failed Societies of Computing: Committee Z and the Professionalization of Programming

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Neither the Association for Computing Machinery (ACM) nor the Computer Society of the IEEE can properly claim to be the first professional organization devoted to digital computing. That distinction is better placed with Committee Z, which was a small subcommittee of the American National Research Council. As a professional organization, Committee Z had only a brief moment of glory in the fall of 1945 and vanished shortly thereafter. Nevertheless, as a pioneering computer society, it identified a fundamental division the early computer workers. That division separated hardware designers from programmers, engineers from users. Both groups wanted to direct the new field but in the early years, the engineers held the stronger position.

Formation of Committee Z

Properly, Committee Z was a subcommittee of National Research Council's Committee on the Bibliography of Mathematical Tables and Other Aids to Computation, an organization generally identified as the "MTAC Committee." The Council had been created on the eve of the first world war to offer the advice of professional scientists to the American government, especially to the military. After the armistice of 1918, the Council organized committees to address issues that would benefit the scientific community as a whole. For example, it created a committee to create a scientific handbook and another to prepare a text on statistical methods that could be used in social science.

The Council had a strong contingent of mathematicians who had done war service at the Army's proving ground in Aberdeen, Maryland. This group was interested in the numerical solution of partial differential equations and urged the Council to create a committee that could assemble the literature of numerical computation. In 1934, the Council acceded to their wishes, created the MTAC committee, and installed an Aberdeen veteran, the Brown University mathematician A. A. Bennett, as its chair.

Bennett gave little attention to the committee and eventually surrendered the chair in 1939 without accomplishing anything. His successor, a second Brown University mathematician named R. C. Archibald,

was filled with energy and devoted his considerable attention to the group. Archibald restructured MTAC, creating subcommittees for every aspect of computation that he could conceive. Following a model that had been originally established at the British Association for the Advancement of Science, Archibald designated all of his subcommittees by letters. Committee A was for arithmetic tables. Committee B was for tables of powers. The last committee, which followed Committee U for navigation tables, was the committee for computing machinery, Committee Z.

L. J. Comrie and Human Computers

To lead Committee Z, Archibald turned to L. J. Comrie, the former director of the Royal Nautical Almanac in England. Comrie was one of the first scientists to identify himself with the process of numeric computation. He had first become interested the subject while he was recuperating from a wound he received in the first world war. While resting in a London hospital, he was given the opportunity to do ballistics calculation for the Ministry of Munitions. At the end of the war, Comrie, decided to pursue a doctorate in astronomy, then the most mathematical of the sciences. This decision ultimately led him to the Royal Almanac Office.

At the Almanac Office, Comrie introduced a number of innovations, most notably the introduction of computing machinery. However, Comrie was not a machine designer. He was much more interested in acquiring commercial business machines and adopting them for scientific work. It "is emphatically urged that the possibilities of existing mass-produced machines should be exhaustively explored," he argued. "The [human] computer's art lies mainly in his ability to manipulate the problem and to apply ingenuity and low cunning in developing techniques that take advantage of the mechanical features of the machine."

While working with commercial calculating machines, Comrie discovered an accounting machine that could compute a curve through data points, a process known as polynomial interpolation. This discovery was important for two reasons. First, it greatly simplified the task of preparing certain astronomical tables. Second, it validated the work of the 19th century mathematician Charles Babbage, for Babbage had designed his first computing machine, the difference engine, to do exactly this kind of calculation.

"The [accounting machine] may be called a model Babbage machine," Comrie explained, because "it does all that Babbage intended his difference engine to do and more." With such a background, Comrie was an enthusiastic recruit for Committee Z and was soon supplying MTAC with information about computing machinery and the methods of doing scientific calculation.

Comrie represented a group of scientific workers that were called human computers. At the start of the war, the world contained a couple hundred of these computers. They always stood in a netherland between professional scientists and office workers. They had built an interesting body of knowledge but

that knowledge fell on the fringe of scientific practice. They had established no journal of their own, and written no textbook that explained their work. At best, they could only point to a small literature about computing that centered on a series of pamphlets, the *Tracts for Computers.* These pamphlets were published by the University College, London. Comrie had written one of them.

Professionalization of Computers

The modern scientific society generally has at least four major elements: a membership, a leadership council, a publication, a set of educational standards. The MTAC committee provided three of the four elements. It had a leadership council under the control of R. C. Archibald. It had a publication, called *Mathematical Tables and Other Aids to Computation,* which began operation in 1943. It finally debated the appropriate ways to train and prepare human computers.

The MTAC committee lacked one key element of a scientific society, the membership. As a committee of the National Research Council, it had been established as a membership organization. Archibald, never one to be deterred by such limitations, claimed that the subscribers to the journal constituted his membership. However, such a claim fell short of the mark. Members choose the leadership and set the direction for the organization by their practice. At MTAC, Archibald and a few close advisors, including L. J. Comrie, controlled the organization.

Though the subscribers to *Mathematical Tables and Other Aids to Computation* may not have constituted a true membership, they were not a small group. By 1945, over 300 people subscribed to the journal, including computers in the United States, Canada, and England. Most of these individuals represented the middle strata of human computers, the group that most closely resembled the modern programmer. Since the restart of organization, human computers had divided themselves into three groups. This division was described by Charles Babbage in his 1835 book, *On the Economy of Machinery and Manufacturers*. Babbage, in turn, had taken these ideas of Gaspard de Prony's 1793 calculating office at the French Cadastral Surveying bureau.

The largest of these groups were the workers who did most of the calculation. They usually had little education beyond elementary arithmetic. The top ground consisted of scientists who identified the calculation and provided the mathematical analysis. The members of the middle sector, who were occasionally called planners, were mathematicians who knew how to convert equations into plans for calculation. They understood which methods of calculation were the most efficient, the least prone to error and the appropriate for the computing staff.

In his role as editor of *Mathematical Tables and Other Aids to Computation*, Archibald knew of most of the major projects that were building computing machines. He certainly knew of the work by Aiken had Harvard, Stibitz at Bell Labs, and Caldwell at MIT. Given the speed with which his

journal published an article in the ENIAC, Archibald certainly knew about developments at the University of Pennsylvania as well.

The Massachusetts Conference

As the war came to a close, Archibald and Comrie decided that Committee Z should organize a conference to promote scientific computation. "During the war, there was enormous development in connection with computing devices," Archibald explained to the readership of *Mathematical Tables and Other Aids to Computation*. "Hence it was decided by the Executive Committee of [MTAC] that it was desirable to arrange for a Conference of those in England and America who direct work for large computing machines, and a few others more or less intimately associated with such activity. The object of such a conference is to familiarize each member of the group with present potentialities in the field and to make know probably future developments."

Archibald assembled a conference committee that had a few familiar names from the early days of electronic computation; Sibitz, Aiken and Irvin Travis, who was an engineer on the ENIAC project. However the rest of the committee, including its chair L. J. Comrie, were human computers or directed human computers: D. H. Lehmer, J C P Miller, J. R. Womersley.

The conference, which was held in November 1945, is generally identified as "Massachusetts Conference" in the literature and is the first public discussion of electronic computation after the end of the war. Most of the discussions concerned how scientists could use these new machines. It included demonstrations of an analogue computer, a differential analyzer at MIT, and mechanical digital computer, the Mark I at Harvard.

Archibald had great hope for the conference. He called it "The First Conference" and stated that it "may eventuate that an Annual Conference of this Group is desired." However, the field of computing quickly expanded beyond the control of either Archibald or the MTAC committee.

Far more important than the Massachusetts conference was the meeting held at the University of Pennsylvania in the summer of 1946. The meeting, generally called the Moore School Lectures, brought together most of the early machine designers and laid for the foundation for the development of the electronic computers.

A more immediate challenge to Archibald's leadership came from the National Research Council, which created a new committee on High Speed Computation. This committee was chaired by none other than John von Neumann and included Aiken, Stibitz, and a new leader in the field, John Curtis.

The Founding of the ACM

In the spring of 1947, the High Speed Computing Committee invited Archibald, as the chair of the MTAC committee, to talk with their members. At this meeting, Archibald suggested that his publication, *Mathematical Tables and Other Aids to Computation,* could be used as the journal of record by the new community of computer scientists. The committee was pleased

with this suggestion and graciously accepted the offer.

At the same meeting, the members of High Speed Computing Committee considered the idea of founding a professional society for computation. As a group, the members of the committee were not pleased with the idea. Von Neumann felt that the time "was not yet ripe." The secretary of the committee, John Curtiss, recorded that the opinion of the group was "less favorable towards the early formation of an association." He moved that "no action be taken now in connection with the formation of a society." When the motion came to a vote, the committee approved it unanimously. von Neumann, Aiken, Archibald and John Curtiss all supported it.

In 1947, John Curtis was a new and important leader in the scientific world. He had spent the war as a statistician for the Navy and had been appointed director of the mathematical division of the National Bureau of Standards. In this position, he would have tremendous influence over the development of the electronic computer. Under his direction, the bureau would create the SEAC computer and would work with the Univac Corporation to create the UNIVAC.

In the debates of the High Speed Computing Committee, Curtiss seemed to be siding with von Neumann, Aiken and the other senior leaders of the field by objecting to the creation of a professional society for computing. However, he probably had more complex motives for within weeks he was promoting a new professional society, the Eastern Association for Computing Machinery, the group that quickly became the ACM.

In promoting the ACM, Curtiss angered Archibald. "Some of leading machine men look askance at this organization," Archibald claimed. He further predicted that Curtiss would not occupy his present position beyond 1949."

Archibald never made a complete statement of his objections to the ACM. Yet, made several statements that suggested a deep believe that the development of computing machinery was being directed by the wrong people. The "day is not far off," he wrote, "where there will be a section of the American mathematical Society supplied with the best mathematical minds in the country there combining to develop what is best for the future of Automatic Computing Machines."

The End of MTAC

This view looked backward rather than forward. The new field of computer science would be highly symbolic and require substantial mathematics but it would led by people who came from outside the world of traditional mathematics. In particular, the workers who had done calculations by hand, those who had develop substantial knowledge about the process of computing would vanish with little trace. Committee Z vanished in 1948, when Archibald resigned from the MTAC Committee.

Following Archibald's resignation, National Research Council considered terminating the committee. They ultimately concluded that the journal *Mathematical Tables and Other Aids to Computation* still served a

purpose and appointed a new editor for the publication. However, they clearly stated that the journal would have no role in the new field of computer science beyond the work of publishing articles. Through 1952, when the ACM created its first journal, Mathematical Tables and Other Aids to Computation published many early papers on computer science. However, after that time, the periodical focused on dealing with mathematical problems of the field. It was eventually renamed the *Mathematics of Computation* and transferred to the American Mathematical Society.

Committee Z of the Mathematical Tables and Other Aids to Computation was constrained by both organizational and intellectual problems during its brief moment at the center of the field. Organizationally, it was part of the National Research Council and not a professional society. Hence it was found it difficult to develop the kind of support it would have needed to become a leader in the field.

More importantly, it was hindered by the nature of its readers. Planners of computation for human computers were not the same thing as programming electronic computers. Programming required new skills for a new environment. The old planners, such as L. J. Comrie, may have had skills those of the programmers but they were not the same. Furthermore, those individuals who understood hardware, at least at an abstract level, would have the dominant hand in computer science. Very few people who once served as computer planners made the transition to the electronic computer.

The story of Committee Z is a story of the division between computer builders and computer users and suggests that, at least during the late 1940s and early 1950s, the builders had the upper hand.

Bibliography and Notes. The author has written about Committee Z in two publications, *When Computers Were Human*, Princeton University Press, 2005 and "The Rise and Fall of the Committee on Mathematical Tables and Other Aids to Computation," *IEEE Annals of the History of Computing*, vol 23 no 2, 2001, p 38 – 49. Those two publications, especially the later, contain a full set of references for Committee Z and the Committee on Mathematical Tables and Other Aids to Computation. The records for this organization can be found at the archive of the National Academy of Sciences, though a very complete set of records can be found in the papers of Philip Morse at the MIT Archives. The complete run of the *Journal Mathematical Tables and Other Aids to Computation* is available through JSTOR.