John William Mauchly

Born August 30, 1907, Cincinnati, Ohio; died January 8, 1980, Abington, Pa.; the New York Times *obituary (Smolowe 1980) described Mauchly as a "co-inventor of the first electronic computer" but his accomplishments went far beyond that simple description.*

Education: physics, Johns Hopkins University, 1929; PhD, physics, Johns Hopkins University, 1932.

Professional Experience: research assistant, Johns Hopkins University, 1932-1933; professor of physics, Ursinus College, 1933-1941; Moore School of Electrical Engineering, 1941-1946; member, Electronic Control Company, 1946-1948; president, Eckert-Mauchly Computer Company, 1948-1950; Remington-Rand, 1950-1955; director, Univac Applications Research, Sperry-Rand 1955-1959; Mauchly Associates, 1959-1980; Dynatrend Consulting Company, 1967-1980.

Honors and Awards: president, ACM, 1948-1949; Howard N. Potts Medal, Franklin Institute, 1949; John Scott Award, 1961; Modern Pioneer Award, NAM, 1965; AMPS Harry Goode Memorial Award for Excellence, 1968; IEEE Emanual R. Piore Award, 1978; IEEE Computer Society Pioneer Award, 1980; member, Information Processing Hall of Fame, Infornart, Dallas, Texas, 1985.

Mauchly was born in Cincinnati, Ohio, on August 30, 1907. He attended Johns Hopkins University initially as an engineering student but later transferred into physics. He received his PhD degree in physics in 1932 and the following year became a professor of physics at Ursinus College in Collegeville, Pennsylvania.

At Ursinus he was well known for his excellent and dynamic teaching, and for his research in meteorology. Because his meteorological work required extensive calculations, he began to experiment with alternatives to mechanical tabulating equipment in an effort to reduce the time required to solve meteorological equations. During the course of that experimentation, he conceived of the idea for an electronic version of tabulating equipment-one that would utilize vacuum tubes.[1]

Mauchly was not proficient in the field of electronics at the time, so he went to the Moore School of Electrical Engineering at the University of Pennsylvania for a summer course in 1941 to enhance his knowledge of electronic devices. He made a very favorable impression on the staff and was asked to stay as an instructor, which he did.

During his first few months at the Moore School, he learned of the institution's contractual work for the Ballistics Research Laboratory (BRL) and of BRL's great need for computational equipment to solve ballistics problems. During World War II, BRL was responsible for producing range tables for new artillery that would furnish gunners with the information they needed to aim and fire the weapons appropriately. The calculations required to prepare these tables were extensive. Because new artillery was being built to meet the needs of the war, the ability of BRL to provide the necessary tables was becoming a matter of increasing concern (Goldstine 1972).

[1] Mauchly J.W. interview with Nancy Stern, May 6, 1977.

Mauchly suggested to J. Grist Brainerd, the Moore School's liaison with BRL, and to Herman Goldstine, BRL's liaison with the Moore School, that his idea for a vacuum tube computer would resolve some of BRL's problems. In 1942 he wrote a memorandum, “The Use of High Speed Vacuum Tube Devices for Calculating,” outlining the features of such a machine (Randell 1975).

Thus, Mauchly not only conceived of the idea for this machine, but also understood how it might be applied to problems in ballistics as well as meteorology.[1] Indeed, this vision was in large part responsible for the Moore School contract to build ENIAC, the first electronic digital computer. ENIAC, an acronym for Electronic Numerical Integrator and Computer,[2] was begun in April 1943 and completed in 1946. It had 18,000 vacuum tubes, 70,000 resistors, 6,000 switches, and 10,000 capacitors. The arithmetic unit consisted of 20 accumulators that could operate on 20 numbers and that functioned as high-speed registers, a high-speed multiplier, and a divider-square-rooter. The total cost to the government was $400,000.[3]

Mauchly was principal consultant for the ENIAC project, and J. Presper Eckert, Jr., the man who became Mauchly's close associate, was chief engineer. Eckert was a consummate engineer who, along with other first-rate engineers at the Moore School such as Arthur W. Burks (who was actually a mathematician), T. Kite Sharpless, and Robert Shaw, was able to develop and construct a reliable electronic computer. The principal investigator was John Brainerd.

When ENIAC was completed in 1946, it received widespread publicity.[4]' It was, after all, capable of performing 5000 additions per second; this was considerably faster than any existing device or any machine that was even under development elsewhere. It is no overstatement, then, to suggest that without Mauchly's ideas and his understanding of how the wartime need could be satisfied by this new invention-and without the engineering expertise of Eckert and his associates-the development of electronic digital computers would have been delayed many years.

During the course of development work on ENIAC, Eckert and Mauchly and their associates recognized many deficiencies in this device that, because of wartime exigencies, could not be modified. The machine was extremely large; it consisted of 30 panels occupying an entire room. It could store only 20 ten-digit numbers. And most critically, it could only receive instructions by the external setting of Switches.

In October 1944, the Moore School obtained a supplement to the ENIAC contract for the development of EDVAC, an acronym for Electronic Discrete Variable Automatic Computer, which was to be a stored-program computer with a 1,000-word capacity that would use mercury delay lines for storing data.

During the next 18 months, Mauchly and Eckert and their associates completed ENIAC and began development of EDVAC. John von Neumann became a consultant to the Moore School and assisted the staff in formalizing the stored-program concept for this computer.[5]

---

[1] The source of Mauchly's concepts has been questioned and the patents taken out by invalidated. See biographies of J.V Atanasoff, Clifford Berry, and Earl Larson.

[2] There has been some discussion whether this latter word was originally “Calculator” or “Computer”

[3] Burks, AM, “Electronic Computing Circuits of the ENIAC,” *Proc. IRE*, 1947, p. 756.

[4] US War Department Press Release, Bureau of Public Relations, Press Branch, University of Pennsylvania Archives, 1946.

[5] University of Pennsylvania Archives, March 14, 1945, Notes oil meeting with Dr. von Neumann.

In addition to developing the US's first general-purpose electronic digital computer, therefore, Mauchly and Eckert and their associates were also responsible for developing the first machine with stored-program capability. The two inventors left the Moore School in 1946 because of a controversy over the school's new patent policy. At this point, EDVAC was still under development. Their departure seriously inhibited progress on this machine, and it was not actually completed[1] until 1951.

Mauchly was the key figure in developing these machines, and he, perhaps more than anyone else, had a keen awareness of their potential for both scientific and commercial applications. He convinced Eckert in 1946 that the time was ripe for marketing electronic digital computers. Even before commercial and government organizations were aware of the potential of computers, Mauchly was certain that he could apply this equipment to the needs of many users. As a result of his vision, Mauchly was singularly important in effecting the transfer of technology from the academic to the private sector.

Mauchly and Eckert were eager to disseminate information about electronic digital computers. The Moore School asked them to give several lectures during a summer course entitled “The Theory and Techniques for Design of Electronic Digital Computers,” jointly sponsored by the Office of Naval Research and the Army Ordnance Department.[2] The two inventors were important contributors to this course, which was another critical step in the transfer of technology to other organizations in the US and Great Britain.

In June 1946, Mauchly and Eckert formed a partnership for the purpose of designing and marketing a Universal Automatic Computer, called Univac. This computer was to be used for a wide variety of commercial applications. The Census Bureau, with the National Bureau of Standards as its agent, was the first organization to contract for a Univac.[3]9

Eckert supervised the design and construction of the machine. Mauchly was successful at convincing not only the Census Bureau but also several other government agencies, including the Army Map Service and the Air Comptroller's Office, of the feasibility, significance, and great potential of Univac. The government's computers were delivered during the years 1951 to 1953, when Univac became the world's first commercially produced electronic digital computer.'[4]

In December 1948, Eckert and Mauchly incorporated, forming the Eckert-Mauchly Computer Corporation. Eckert became vice president, preferring to remain behind the scenes as chief engineer. Mauchly became president and was responsible for contributing to the logic design of the computer, for disseminating information on the company's progress, for contracts with the A.C. Nielsen Company and the Prudential Insurance Company, and for obtaining additional financial backing from the American Totalisator Company.

In general, Mauchly's main objective was to demonstrate the applicability of electronic digital computers for a wide range of problems. He was also interested in providing a forum where people in the computing field could discuss their respective projects. To this end, he was active in founding and organizing the Eastern Association

---

[1] Engineering Research Associates, *High Speed Computing Devices*, McGraw Hill, New York, 1950, p. 215.

[2] University of Pennsylvania Archives, “The Theory and Techniques for Design of Electronic Digital Computers,” 3 vols., 1948.

[3] NBS, National Bureau of Standards Contract DA-2, University of Pennsylvania Archives, October 24, 1946.

[4] NBS, “History of NBS Programs for the Development and Construction of Large-Scale Electronic Computing Machines,” National Bureau of Standards Archives, n.d.

for Computing Machinery in 1947, which later became the Association for Computing Machinery. Mauchly was this organization's first vice president in 1947 and its second president in 1948. He was also a founder and president of the Society for Industrial and Applied Mathematics (SIAM).

Because Eckert and Mauchly were trying to sustain themselves in a high-technology field, they were continually in need of additional capital. In an effort to alleviate some of their financial problems, they undertook a second computer project in 1947 for the Northrop Aircraft Company for design of a small-scale binary computer. BINAC, an acronym for Binary Automatic Computer, was completed in 1949 and became the first US operational stored-program electronic digital computer (Stern 1981). In short, then, Mauchly and Eckert were responsible for four significant “firsts” in the computing field: ENIAC, EDVAC, BINAC, and Univac.

During the late 1940s, American Totalisator had agreed to finance Eckert and Mauchly's research and development work. But in October 1949 the key man responsible for the support, Henry Straus, vice president of Totalisator, was killed in an airplane crash. This put the Eckert-Mauchly Computer Corporation into very serious financial straits. Having exhausted all efforts to obtain additional support, the two inventors sold their company to the Remington-Rand Corporation in February 1950. Remington-Rand then merged with the Sperry Corporation in 1955 to form Sperry-Rand.

Both Mauchly and Eckert continued to work for Remington-Rand. Even after Univac I was completed, Eckert remained in his capacity as engineer. Mauchly became directly involved with the logic design and software for Univac, an area that had interested him since his ENIAC days. He made significant contributions to the programming of Univac and was responsible for developing the C-10 programming code.

Mauchly continued to work for the Univac division of Sperry-Rand as director of Univac Applications Research until 1959, when he formed Mauchly Associates, an organization that developed computers for scheduling purposes and introduced the critical path method (CPM) for scheduling by computers. He also formed a consulting company called Dynatrend in 1967.

During his prolific career, Mauchly received many honors. He was the recipient of the Howard N. Potts Medal of the Franklin Institute in 1949, the John Scott Award in 1961, the Modern Pioneer Award of NAM in 1965, the Harry Goode Memorial Award for Excellence in 1968, and the Emanual R. Piore Award of IEEE in 1978.

But like many other pioneers who played an important role in effecting a technological revolution, Mauchly never really received his share of recognition. Despite the tremendous impact computers have had in less than 40 years of development, pioneers in this field are not, in general, well known outside the computing area. Whereas Samuel Morse and Alexander Graham Bell, just to name two inventors, achieved significant fame, Mauchly and his colleagues never received very much publicity. As the *New York Times* stated in a 1971 editorial (Smolowe 1980), it was a “gross injustice” that the names of Mauchly and Eckert were “not likely ever to become household words on a par with the Wright Brothers or Thomas A. Edison, let alone the Beatles.” Part of this lack of recognition is a result of litigation that in many instances attempted to minimize the contributions of specific inventors in an effort to invalidate patents. In addition, the fact that the computer field is so new means that historians have not, for the most part, had the opportunity to evaluate the history and the specific contributions of key pioneers. Moreover, in Mauchly's case, his contributions tended to be more intangible than those of engineers and hence more difficult to evaluate.

He was devoted to his family and is survived by his wife, the former Kathleen McNulty, who was a programmer for ENIAC, seven children, 17 grandchildren, and two great grandchildren. It is impossible to mention all his wide-ranging interests and contributions in areas not related to computers, like his invention of snap caps for bottle tops and his formation of the Bach Society in Pennsylvania, to name just two.

For most of his life, John Mauchly sought to guide, advise, and educate. He was a person with interesting and even exciting ideas, but he can best be described as highly intelligent, very warm, gentle, and honest. He was always eager to explain the vast potential of computers—especially microcomputers in recent years. His interest in the younger generation was inspiring; indeed, his rapport with young people was truly remarkable.[1]

QUOTATION

Kathleen Mauchly, regarding the challenges to Mauchly's originality of thought with regard to the "invention" of the computer: "In the file were carbons of letters showing that Mauchly had been actively working on a computer at Ursinus-something he had claimed all along." (Mauchly 1984)

BIBLIOGRAPHY

Biographical

Anon., "John Mauchly Dies," *Charles Babbage Institute Newsletter,* Vol. 2, No. 1, Jan. 31, 1980, pp. 1, 4.

Berkeley, Edmund C., *Giant Brains* or *Machines That Think,* John Wiley & Sons, New York, 1949.

Burks, Arthur W., and Alice R. Burks, "The ENIAC: First General Purpose Electronic Computer," *Ann.* Hist. Comp., Vol. 3, No. 4, 198 1, pp. 310-399.

Costeflo, John, "He Changed the World," *The Washingtonian,* Dec. 1983, pp. 82-100.

Eckert J Presper, "The ENIAC," in Metropolis, N.J. Howlett, and Gian-Carlo Rota, *A History of Computing in the Twentieth Century,* Academic Press, New York, 1980, pp. 525-539.

Goldstine, H.H., *The* Computer from *Pascal* to von *Neumann,* Princeton Univ. Press, Princeton, NJ., 1972, p. 138.

Larson, E.R., Findings of Fact, Conclusions of Law and Order for judgment, File No. 4-67 Civ. 138, Honeywell Inc. vs. Sperry-Rand Corporation and Illinois Scientific Developments, Inc., US District Court, District of Minnesota, Fourth Division, Oct. 19, 1973.

Mauchly, John W., "The ENIAC," in Metropolis, N.J. Howlett, and Gian-Carlo Rota, A *History of Computing in the Twentieth Century,* Academic Press, New York, 1980, pp. 541-550.

[1] From Stern 1980.

Mauchly, Kathleen, “John Mauchly's Early Years,” *Ann. Hist. Comp.*, Vol. 6, No. 2, 1984.

Randell, B., ed., *The Origins of Digital Computers,* Springer-Verlag, New York, 1975, pp. 329-332.

Ritchie, David, *The Computer Pioneers,* Simon and Schuster, New York, 1986.

Slater, Robert, *Portraits in Silicon,* MIT Press, Cambridge, Mass., 1987.

Smolowe, J., “John W. Mauchly, a Co-inventor of the First Electronic Computer,” *The New York Times,* Jan. 9, 1980, D21.

Stern, Nancy, “The BINAC: A Case Study in the History of Technology,” *Ann*. Hist. Comp., Vol. 1, No. 1, July 1979, pp. 9-20.

Stern, Nancy, “John William Mauchly: 1907-1980,” *Ann. Hist. Comp*., Vol. 2, No. 2, 1980, pp. 100-103.

Stern, Nancy, From *ENIAC* to *Univac: An Appraisal of the Eckert-Mauchly Computers,* Digital Press, Bedford, Mass., 1981.

Tropp, Henry S., “John W. Mauchly,” in Ralston, A., and C.L. Meeks, eds., *Encyclopedia of Computer Science,* Pertrocelli/ Charter, New York, 1976, pp. 871-873.

Tropp, Henry S., ed., “Mauchly: Unpublished Remarks,” *Ann. Hist. Comp.,* Vol. 4, No. 3 July 1982, pp. 245ff.

Tropp, Henry S., “Mauchly, John William,” in Ralston, Anthony, and Edwin D. Reilly, Jr., *Encyclopedia* of *Computer Science and Engineering,* Van Nostrand Reinhold Co., New York, 1983.

Significant Publications

Eckert, J. Presper, Jr., John W. Mauchly, Herman H. Goldstine, and J.G. Brainerd, *Description of the ENIAC and Comments on Electronic Digital Computing Machinery*, Contract W/670/ORD 4926, Moore School of' Electrical Engineering, Univ. of Penn., Philadelphia, Nov. 30,1945.

Mauchly, J.W., “The Use of High Speed Vacuum Tube Devices for Calculating,” reprinted in Randell, Brian, *Origins of Digital Computers: Selected papers,* Springer-Verlag, Berlin, 1982, pp. 355-358.

Mauchly, J.W., “Preparation of Problems for EDVAC type Machines,” reprinted in Randell, Brian, *Origins of Digital Computers: Selected Papers*, Springer-Verlag, Berlin, 1982, pp. 393-398.

UPDATES