BOOKS: COMPUTING

Toward the Invisible Computer

Martin Greenberger

Michael Dertouzos's eighth and final book is an important one. Convincingly perceptive about computers past and present, *The Unfinished Revolution* sets a human-centered agenda for the future of computing. It is a persuasive book and for me a nostalgic one as well. Dertouzos, the director of the Laboratory for Computer Science at the Massachusetts Institute of Technology (MIT) for 27 years and someone I knew for nearly 40, passed away this year in August.

Michael came close to naming the book "Doing More by Doing Less," a phrase he invokes in almost every chapter. He had a long-standing interest in productivity, which he personified in his own career. But given the broad sweep of the book's concerns, *The Unfinished Revolution* is a better title. Dertouzos admonishes the computing industry for mistreating people, and he prescribes as the remedy a major redirection of research and development. The book emphasizes the essential roles to be played by users of future computer technology and the necessity of having the technology fit better with human needs and human nature.

Although improved efficiency is one argument for developing a better human fit, the book offers an even worthier reason. Making computers less formidable and less demanding would extend their benefits to much larger numbers of people worldwide. Such "democratization of computing" was very much on Dertouzos's mind.

The phrase "unfinished revolution" recalls personal computer–pioneer Alan Kay's line, "The computer revolution hasn't happened yet." Kay draws an analogy with the history of an earlier information technology, the printing press. He believes the printing revolution did not happen with Gutenberg's invention of movable type in the mid-15th century or with Aldus Manutius's development of portable books 50 years later. The revolution occurred only when educated people began routinely thinking and writing in the style of reasoning that printing made possible; that took a good 200 years.

Dertouzos earned a doctorate in electrical engineering from MIT in the early 1960s. It was a time when, aided by funding that J. C. R. Licklider arranged from the U.S. Department of Defense's Advanced Research Projects Agency, we were establishing MIT's Project MAC ("Multiple Access Computer" or "Machine-Aided Cognition") to develop human-computer symbiosis within a time-sharing, utility-like operation. Computer networks were coming into vogue by 1974, when Dertouzos became the fourth director of Project MAC. To make the mission seem less transitory and to better reflect the researchers' expanded range of activities, he changed its name to Laboratory for Computer Science.

In Dertouzos's vision, formulated in 1980 (shortly before personal computers began to blossom), time-sharing systems and information utilities were the "opening lines of a fast-moving play." They would lead to a decentralized "information marketplace," where millions of interconnected people would buy, sell, and exchange information and services, much as goods were traded in the Athens flea market he knew as a boy. Dertouzos's information marketplace foreshadowed the World Wide Web, whose inventor, Tim Berners-Lee, he helped and encouraged. He arranged for Berners-Lee to come to MIT in 1994 to work in the Laboratory for Computer Science and to form the Web Consortium there.

Dertouzos thought the information revolution would not be complete until computers were as invisible, pervasive, essential, and effortless to use as oxygen in the air. To help transform that vision into reality, in 1999 he and his collaborators initiated an ambitious research program at MIT called "Project Oxygen." He devotes one chapter of the book to outlining the program's five research areas (speech recognition, automation, information access, collaboration, and customization), which he believed could bring us closer to human-centric computing.

In a remembrance, Charles Vest, the president of MIT, observed that Dertouzos was "larger than life…a leader, builder, visionary and caring human being." Michael could also be provocatively eloquent, as at the end of *The Unfinished Revolution*:

> What does reason have to do with the love of a child, the beauty of a flower, the eternity of stone, our origin, our destination?…[We] overrate reason at the expense of spirituality, and technological reason at the expense of humanistic ideas.
>
> The highest meaning of "human-centric," and its biggest benefit to us, will be determined by what we do to achieve the human goals we set.

By Dertouzos's reckoning, the ongoing information revolution began in the 1950s (others would say it started in the 1940s, or even the late 1930s). He anticipated achieving his stated goals by 2020, and he estimated that an additional two decades would be required to complete the effort. By any account, we are now in the second half of the quest. The end will come only when computers vanish from view. It will take a while, but the ideas and vision that Dertouzos promotes in the book could help us through the final phase of the revolution.

Michael Dertouzos.

The Unfinished Revolution
Human-Centered Computers and What They Can Do For Us
by Michael Dertouzos

HarperCollins, New York, 2001. 240 pp. $26, C$39.50, £10.99. ISBN 0-06-662067-8.

The author is at The Anderson School of Management, University of California, Los Angeles, 110 Westwood Plaza, Box 951481, Los Angeles, CA 90095–1481, USA. E-mail: mg@ucla.edu

BOOKS: APPLIED PHYSICS

High-Density Intro to Information Devices

David G. Goodwin

Ever since Samuel Morse transmitted "What hath God wrought?" by telegraph from Washington to Baltimore in 1844, major advances in information technology have often been the direct result of advances in physics or physics-based technology. The telegraph could only be developed after magnetic induction was discovered. The development of the transistor could not have occurred without a prior understanding of the energy band structure of solids, which in turn was only possible once the underlying quantum mechanics had been worked out.

The author is in the Division of Engineering and Applied Physics, California Institute of Technology, Mail Code 104-44, 1200 East California Boulevard, Pasadena, CA 91125, USA. E-mail: dgg@its.caltech.edu