

tion is really needed. To analyze Blum's arguments would require someone well-grounded in classical studies, who would necessarily have to be able to read the original German. The general picture of the Alexandrian library, and the methods and achievements of Kallimachos—subjects which might have attracted the interest of readers without backgrounds in classical studies and innocent of German—remain entangled in the unfriendly prose and dense arguments of the text.—Edward Shreeves, *University of Iowa, Iowa City.*

**Gelernter, David.** *Mirror Worlds: Or the Day Software Puts the Universe in a Shoe Box . . . How It Will Happen and What It Will Mean.* New York: Oxford Univ. Pr., 1991. 237 p. acid-free, \$24.95 (ISBN 0-19-506812-2). LC 91-19178.

In *Mirror Worlds* David Gelernter joins the ranks of computer scientists who have attempted to provide the nontechnical reader with a glimpse of the future of information technology. Gelernter teaches computer science at Yale and specializes in programming languages for what is known as massively parallel computation. His book is both an explication of the software architecture for parallel programming and a vision of the potential applications of this technology.

A *mirror world* is a software model of reality, fed and constantly updated by rivers of data pouring in from remote sensors and databases. For the user, the intricate complexity of a city, corporation, hospital, or any other institution is collapsed into a single, recognizable but constantly changing image on a computer screen. The user can zoom in on the intimate details, or zoom out for a global picture, open up television pictures of actual events taking place at that moment, or move back in time, delving into the historical record.

To support these mirror worlds, vast computer power is needed, much more than can be reasonably expected from single programs on single machines. Gelernter proposes as an alternative "asynchronous software ensembles,"

myriads of separate programs, running on separate machines but cooperating, communicating, and coordinating with each other over high-speed networks. Some of these ensembles take the form of personal "agents" that act as information gatherers for the individual user; others are more like general-purpose utilities, floating in some computational hyperspace, available for anyone to use. Gelernter likens these to piranhas waiting for a meal to present itself. As a task "floats by," the programs "attack" it and solve whatever parts they can. The remaining parts float on until the entire task is solved, and the results are gathered up by those agents "interested" in them.

Supporting the mirror worlds is a vast "Tuplesphere" of information and programs distributed via a global network from countless machines and databases. "While we're at it," Gelernter writes, "we might as well take the world's libraries, digitize them and dump them into the Tuplesphere as well," with the all-too-common computer science insouciance for the time, cost, and legal issues involved in such an action.

Gelernter describes at some length how programs work and how his "Linda" system coordinates the actions of many simultaneous programs. He manages through analogy and metaphor to convey a sense of what is really going on in massively parallel computation (at least for the Linda model) in terms that should be understandable to the intelligent layperson. For readers with a technical background, there are a few references to his textbook on parallel programming.

Gelernter's writing style ranges from the folksy to occasional bursts of visionary lyricism. One passage, describing a program he calls an "infomachine" is reminiscent of the science fiction writing of William Gibson: "An infomachine bursting forth into the emptiness of computer-science is a fireworks chrysanthemum—intricate tracery drawn carefully on nothing, hanging in a void, ungraspable, unfolding automatically—but real, vivid and striking. It burns fast and bright, transforms galaxies of com-

bustible data into information, then falls back into nothing and disappears. Designing this kind of—'whatever'—structure, 'event'—is one of the most inspiring challenges engineers and designers have ever faced; and one of the hardest."

Gelernter is also concerned with the social and political implications of mirror worlds and discusses who will use them and for what purposes. He is of two minds, personified as "John" and "Ed" in the curious epilogue to the book. Ed is worried that the technology will kill interest in the real world and leave people with the experience of "a perfectly clean, neat, analytical silence." John is enthusiastic about the possibilities of the vast and personalized vision offered by mirror

worlds. Ed fears a sort of "information serfdom" with total dependence on the programmers and information providers, while John sees an enhanced ability to comprehend and influence the community and the world. Both are alteregos for Gelernter, expressing his hopes for and fears of the technology.

Most of the pieces of technology that could make up a mirror world already exist on a much smaller scale in the laboratory. It remains to be seen if, and how, and when, these small "infostructures" might be assembled into the sort of software Gothic cathedrals envisioned by Gelernter, and, if they are, how we will use them.—*Ray R. Larson, University of California, Berkeley.*