

ly and informatively, there is simply too much theory and too many formulas to be comfortably digested. Because of the emphasis on the specifics in each field rather than the general principles involved, the relationship between AI and the subjects under discussion is unclear. Some topics, such as Teitelman's algorithm for recognizing handwritten characters, were extremely difficult to decipher. The appropriateness of including such in-depth treatments in an introductory text on AI is questionable. Thankfully, Firebaugh reverts to his more characteristic style with the subsequent chapter on machine learning. Here is a highly focused discussion; the concepts, applications, and relative merits of various machine learning techniques and their relationship to AI are neatly presented.

The reader is left to ponder the future direction of AI in the closing chapter. Current limitations and the potential of parallel processing to alleviate some of these limitations lead naturally into a detailed discussion of neural networks. A great deal of information is available here for the uninitiated. Maligned early on, as was the entire field of AI for promising more than it could deliver, neural networks are staging a comeback, and solid evidence is presented for the continuation and expansion of current research efforts.

The book also contains two appendixes. Appendix A, written by Yong Y. Auh, is a fine tutorial on the Lisp programming language. Appendix B contains a summary of commercially available AI systems, including expert system shells, and can be helpful to one seeking tools for a specific application.

One disturbing aspect of this text is that it is littered with poor grammar and typographical errors. The problems include incorrect tense; plural-singular mismatches; improper punctuation; poor sentence structure; and wrong, duplicate, or missing words. There are also more than a few instances of inappropriate splitting of paragraphs and sections between adjacent pages and of ill-advised placement of illustrations. These lapses are unfortunate because they detract from the reading pleasure and unnecessarily degrade an otherwise well-written book. To alleviate these problems, a thorough proofreading is a must prior to pub-

lishing the next edition.

A textbook is intended to serve as one of the three main components of the learning environment, along with classroom instruction and homework assignments. Although a textbook is primarily used to supplement the instruction and to refer to when completing assignments, this text goes beyond these minimum requirements. It is a valuable learning tool and would be highly informative even if read without benefit of the other two components. The major flaw in Firebaugh's book is the author's tendency at times to introduce too many new concepts with too little explanation.

Firebaugh states in his introduction that his objectives were "to introduce students to the major ideas of Artificial Intelligence [and] to provide the student with at least a conceptual introduction to all major areas of AI and a working knowledge of many of the more practical and applied areas." I can attest to the fact that these objectives were indeed achieved.

Joseph Montanarella obtained his Master's in computer science from the Rochester Institute of Technology in 1989 and is currently employed at IBM in the Research Triangle Park in North Carolina as an associate programmer.

The Media Lab

Lee S. Brownston

Stewart Brand, of *Whole Earth Catalog* fame, is a technology enthusiast. In 1986, he spent three months in the fantasyland of his choice, MIT's Media Laboratory (formerly the Architecture Machine Group). In his latest book, *The Media Lab: Inventing the Future at MIT* (Viking/Penguin, New York, 1988, 285 pp., \$10, ISBN 0-14-009701-5), he tells the world what he found. Brand's enthusiasm is infectious: His report would make any working programmer ache to be part of this heady mix of visionaries, hackers, artists, scientists, and entrepreneurs, where flakiness is a positive value, and freedom and money are seemingly without bounds. However, this book is not for technically sophisticated readers alone; it is the kind of book you can give your grandmother to illustrate the existential pleasures of

engineering, in Samuel Florman's phrase.

Brand follows the familiar format of much science reporting, carefully describing and sketching the personalities of the Media Lab stars as hooks to describe their work. His style is breezy and personal, with a sly, sometimes tart wit that somewhat offsets his awe.

In the first of the book's two parts, *The World of the Media Lab*, which composes roughly two-thirds of the book, Brand's personality profiles are skillfully woven with historical and technical background information, anecdotes, and descriptions of the technical achievements; the second part, *The Media Lab of the World*, analyzes the social implications of the technologies being pursued at the Media Lab and elsewhere. There are numerous black-and-white photographs of the people whose work is discussed and a section of color photographs illustrating the work environment and the projects. As a bonus, embossed on the cover is a white-light hologram that illustrates one of the laboratory's successful research projects.

Brand evidently found the Media Lab people to be congenial; they are described so warmly and respectfully that if he didn't truly admire and like everyone whom he wrote about in this book, he did a good job of hiding the fact. Sometimes, the author is so dazzled with lab members that he inserts lightly edited transcripts of his interviews with his interlocutors; these transcripts are not as fascinating to the reader as they evidently were to the author. For example, a long interview with Andrew Lippman is presented almost verbatim to illustrate some of Lippman's ideas concerning conversational discourse. However, the didactic value of performing the transcription must have been greater than the value of reading the result. Granted the interviewees are articulate and present valuable ideas, but a little more digestion would have been appropriate.

Brand's admiration is in marked contrast to the evident distaste of Sherry Turkle: In her book *The Second Self*, she made little attempt to conceal her revulsion at the personalities, tastes, and ideology of many of the same people. Where Turkle stressed the nerdiness and intellectual arrogance of MIT's

(admittedly brilliant) hackers, Brand accentuates their creativity and enthusiasm. Part of the Media Laboratory's heritage (its origins are in the School of Architecture) is a startling receptivity to the arts, especially music and the visual arts, and Brand repeatedly returns to this subject. Even here, intellectualism reigns: It is symptomatic that the lab members' interest in literature seems to be limited to science fiction. This lopsidedness echoes Turkle's complaint that hackers ignore the texture (emotion) of music in favor of its structure (intellect).

Not an engineer himself, Brand is not always in a position to critically evaluate what he saw; I was reminded of persons who, on seeing ELIZA, concluded that computerized psychotherapy was just around the corner. As Brand points out, the Media Lab replaces the publish-or-perish imperative with demo or die, and anyone who has produced a demo knows something about practical mendacity. Brand also tends to give short shrift to the perverse ways in which market forces can sabotage visionary ideas and to the disturbing potential of these technologies, for example, as part of government spying efforts on citizens and in widening and solidifying class differences; reducing the quality of free speech by overwhelming us with quantity; and, of course, facilitating aggression. Finally, there was no attempt to balance the boosterism of the lab's enthusiasts (such as the director, Nicholas Negroponte, whom he describes as a world-class salesman) with the critical assessments of the value of their work. The author is on the side of the visionaries, not the skeptics.

Brand manages to describe a fair number of research projects in this medium-length, popular survey and to be lucid and inspiring about most of them, although the low level of technical detail might leave many sophisticated readers unsatisfied. After briefly sketching Nicholas Negroponte's biography and philosophy in the first chapter, Brand lists the 11 project groups (circa 1986) that the book discusses: (1) electronic publishing (Walter Bender on NewsPeek, an electronic newspaper that adapts to the user's preferences, and Andy Lippman on interactivity), (2) speech (Chris Schmandt on a speech-understanding voice message system), (3) an advanced television

research program (William Schreiber on high-density TV [HDTV] and Steve Benton on an advanced beam-mixing television display), (4) movies of the future (putting feature-length movies on laser disks, thereby ushering in paperback movies), (5) the visible language workshop (Muriel Cooper in collaboration with professional designers to better exploit computer graphics), (6) spatial imaging (Stephen Benton on printed and projected holography), (7) computers and entertainment (Alan Kay on the Vivarium, a detailed computer model of an ecosystem using sophisticated graphics and robotics), (8) animation and computer graphics (David Zeltzer on the modeling of biological motion and Carl Feynmann on the physics of clothing), (9) computer music (Barry Vercoe on his robotic piano accompanist and Tod Machover on interactive and improvisational music programs), (10) the school of the future (Seymour Papert on his LOGO project), and (11) the human-machine interface (psychologist Richard Bolt on his research on using eye movements as input). Woven into the discussions of Media Lab research are brief sketches of related work that did not originate in the Media Lab but that is just as fascinating.

Members of the AI community will probably already be familiar with the ideas of Marvin Minsky, Seymour Papert, and Daniel Hillis from these scientists' own publications or from scuttlebutt. The material on HDTV, antialiasing, user interfaces, holography, and computer music will be familiar to fewer AI people but nonetheless absorbing. The chapters that are most likely to be new and fascinating concern the long-range, global implications of rapidly developing communication and computing technologies. Although much of the discussion along these lines is either conventional wisdom or wildly speculative, the views of professional trend-watchers Peter Schwartz and Jay Ogilvy are enlightening and persuasive, although they are unfortunately presented as transcripts of conversations.

In summary, *The Media Lab* is an attractive, entertaining, well-written, light technical book for general audiences. It has a useful bibliography but a somewhat larger index than a book of this type really needs. For workers in computers and communications, it can serve as a pleasant, if shallow,

introduction to new and provocative ideas as well as a pointer to additional information. Like Richard Feynman's two books of memoirs and Gleick's *Chaos*, this book will be passed among workers in computer and engineering departments as a good read.

Lee S. Brownston is a senior member of the technical staff in the Artificial Intelligence Department of FMC Corporate Technology Center, Santa Clara, California. He is a coauthor (with Robert Ferrell, Elaine Kant, and Nancy Martin) of *Programming Expert Systems in OPS-5*.

Representation and Reality

Lee A. Gladwin

In *Representation and Reality* (MIT Press, Cambridge, Mass., 1988, 134 pp., \$19.95, ISBN 0-262-16108-7), Hilary Putnam, the father of functionalism, turns on his mind child, declaring that "functionalism, construed as the thesis that propositional attitudes are just computational states of the brain, cannot be correct." After years of reflection, he now argues that the mind-machine analogy fails to answer the question, What is the nature of mental states? He describes functionalism as a reaction to the "idea that our matter is more important than our function, that our what is more important than our how"; that is, a machine or human brain could all "work much the same way when described at the relevant level of abstraction," and it is wrong to think that the essence of our minds is our hardware.

Although still retaining this view, Putnam states that his previous arguments "to show that a simpleminded identification of mental states with physical-chemical states cannot be right can be generalized and extended to show that a straight-forward identification of mental states with functional states, i.e., with computationally characterized states, also cannot be right."

Putnam takes issue with the attempt to unify belief-desire psychology with a computational model of the mind by identifying beliefs and desires as functional states. He proceeds to reject Jerry Fodor's notion of innate universally held concepts that can be decomposed