PAMELA McCORDUCK

MACHINES WHO THINK

BIBLIOTHEQUE DU CERIST

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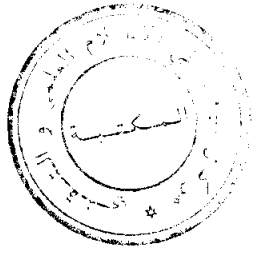
Machines Who Think

A Personal Inquiry into the History and Prospects of Artificial Intelligence

Pamela McCorduck



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Part I Beginnings

1 Brass for Brain 3

Surveys attempts before the twentieth century to create artificial intelligences, both literary and real. Argues that twentieth-century artificial intelligence is only the latest, though the most successful, instance of a long Western tradition, and shares much with its ancestors.

2 From Energy to Information 30

Delineates the early attempts of philosophers, and later psychologists, to define the mind, and the parallel attempts of mathematicians to turn human logic into rigorous mathematics. Shows that the dominant model for these thinkers was from physics, and that not until cybernetics introduced a new model—information in an open system, as opposed to energy in a closed system—could the computer successfully be used as a medium for intelligent behavior.

3 The Machinery of Wisdom 48

Focuses on the computer as a medium for intelligent behavior, with close attention to Alan Turing, a brilliant British logician who helped

design one of the first computers and was responsible for much early work in artificial intelligence. Discusses the American pioneer John von Neumann, who held a view opposite to Turing's, that computers would never be able to "think."

4 Meat Machines 70

Traces the growing conviction that brains are a species of machine, the failed attempts to equate the on-off logic of the computer with the on-off logic of brain neurons. Reviews the early work of McCulloch and Pitts, as well as self-organizing systems, the Perceptron, and other attempts in the United States and Great Britain to link brains and machines.

Part II The Turning Point

5 The Dartmouth Conference 93

Reports on a conference that in 1956 gathered the threads of an assortment of projects with the same general underlying assumptions. Everyone was there, and the conference served as a rite of tribal identification that set patterns for future research and personal relations.

6 The Information-Processing Model 115

Covers the pioneering work of Newell, Shaw, and Simon, which set the tone for the next decade of research. The influence of these men on computing and cognitive psychology so pervades those fields that their discoveries and models are simply taken for granted.

7 Fun and Games 146

Describes how computers were taught to play chess and checkers, and why this development made IBM so nervous. Analyzes the scientific and social significance of computer games.

Part III Resistance

8 Us and Them 167

Discusses the critics of artificial intelligence, who give the lie to the idea that science is a disinterested enterprise. Includes some speculations as to why artificial intelligence seems to provoke people to extremes, and covers the first extremist, Mortimer Taube, author of Computers and Common Sense.

9 L'Affaire Dreyfus 180

Considers the bitterest critic of artificial intelligence, who examined the evidence and found it wanting. However, a computer walloped

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him at chess, and his demands continue to be met. (Or do they?) Dreyfus and his book What Computers Can't Do *are introduced as fixtures in the artificial-intelligence community, and the man is presented as an example of the committed mind that finds only what it expects to find, even as scientists with the opposite commitment find what they expect to find. Relates prophecies, insults, and other scientific high jinks—a case study in the subjective side of science and philosophy.*

Part IV Realizations

10 Robotics and General Intelligence 209

Investigates the robot and the difficulty of general, as opposed to special-purpose, intelligence. Presents two approaches, the General Problem Solver and the Advice Taker, and inspects some of the problems and solutions robot makers have encountered. Focuses on Shakey, the SRI robot, who rolled into the hearts and fears of millions—thanks to some scurrilous publicity.

11 Language, Scenes, Symbols, and Understanding 239

Views some of the interesting projects of the 1970s having to do with language, scenes, symbols, and understanding. Concentrates on language understanding, written and spoken, and parallel problems in visual analysis.

12 Applied Artificial Intelligence 272

Examines a here-and-now application of artificial intelligence in DENDRAL, the program that assists organic chemists, and some of its collateral programs. Looks at the MIT education laboratory, which applies artificial-intelligence principles in a different way.

Part V The Tensions of Choice

13 Can a Made-Up Mind Be Moral? 305

Asks the questions: Can artificial intelligence really be created? If it can, should it? Reflects on the moral and ethical dimensions of artificial intelligence. Reviews Weizenbaum's Computer Power and Human Reason *and responses to it.*

14 Forging the Gods 329

Appraises the central scientific claim of artificial intelligence: that it demonstrates how symbols can be embodied in a physical system, serving as a key to the understanding of mind as the theory of evolution was to the understanding of biology. Regards artificial intelligence as a bridge between science and art, telling us about ourselves in some startling ways. Speculates as to future directions.

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