

Is Man a Machine? Three Books on the Computational Model of the Mind

Publisher: IEEE

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Abstract

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» We review Three Recent Books on Artificial Intelligence, the Computational Model of the Mind, and the “Hard Problem” of Consciousness

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Abstract:

Presents reviews for the following list of books, Is Man a Machine? Three Books on the Computational Model of the Mind.

Published in: IEEE Technology and Society Magazine (Volume: 44 , Issue: 3, September 2025)

Page(s): 44 - 46DOI: 10.1109/MTS.2025.3593312

Date of Publication: 12 September 2025Publisher: IEEE

✓ ISSN Information:

In The Mid-1740s, French philosopher Julien Offray de La Mettrie declared Man a Machine. Two centuries later, in the mid-1940s, a middle-aged neurosurgeon and a teenage self-educated symbolic logician speculated that the synapses in our neural networks might be doing binary calculations, i.e., the Brain is a Computer. It is now eight decades since that first idea that the synaptic connections between brain neurons might be binary logic transmitting “all or nothing” action potentials along neurons (1s or 0s) to the next synapse and solving problems in propositional logic. It is important to remember that in 1943, this was still just an idea. True, it was seven years after Alan Turing in 1936 proposed his “universal computing machine.” However, the idea was a couple of years before the first digital computers (Colossus in the United Kingdom in 1945 and ENIAC in the United States in 1946) were actually constructed. Nevertheless, this 1943 idea that a brain might compute has become the nearly universal opinion of “computational neuroscience” today: the brain is a digital computer, as seen in three recent books.

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Is Man a Machine? Is the Brain a Digital Computer? Is an AI Large Language Model Conscious?

The original idea that brain neurons might form logical networks was the work of 45-year-old Warren McCulloch, who trained as a neurosurgeon in New York hospitals and had studied symbolic logic with Frederic Fitch, the Sterling professor of logic at Yale (see [6], [7]). McCulloch had a brilliant assistant in teenager Walter Pitts, who had been reading Bertrand Russell and Alfred North Whitehead’s *Principia Mathematica* since he was 12 years old and had easily digested the math of Turing’s idea. When Pitts was just 15 years of age, he wrote to Russell, who invited Pitts to attend his upcoming visiting lectures at the University of Chicago and suggested that Pitts meet with Rudolf Carnap to discuss symbolic logic. Pitts walked into Carnap’s office with a marked-up copy of Carnap’s famous text, “The Logical Syntax of Language,” and then left without telling Carnap how to contact him. It took Carnap months to locate the homeless Pitts and give him a minor job with a modest income (see [4], [8]). At that time, McCulloch was also in Chicago, a professor of psychiatry at the University of Illinois, and he met Pitts at seminars organized by Nicolas Rashevsky, the founder of Mathematical Biology and publisher of the Bulletin of Mathematical Biophysics, where McCulloch and Pitts published their landmark article, “A Logical Calculus of the Ideas Immanent in Nervous Activity” [1]. Also, in Chicago at that time and attending Rashevsky seminars was Jerome Lettvin, studying for a medical degree at the University of Illinois. McCulloch invited Pitts and Lettvin to live in his large home where they spent long nights discussing brain networks. Years later, when Cybernetics founder Norbert Wiener invited the three to M.I.T., these discussions led to their article “What the Frog’s Eye Tells the Frog’s Brain,” which appeared in the 1959 *Proceedings of the IRE* [2]. In their classic 1943 article, McCulloch and Pitts wrote, “Because of the ‘all-or-none’ character of nervous activity, neural events and the relations among them can be treated by means of propositional logic.” Their article also explicitly compared the behavior of neural networks to a Turing machine. “One more thing is to be remarked in conclusion. It is easily shown: first, that every net, if furnished with a tape, scanners connected to afferents, and suitable efferents to perform the necessary motor-operations, can compute only such numbers as can a Turing machine... This is of interest as affording a psychological justification of the Turing definition of computability and its equivalents, Church’s definability and Kleene’s primitive recursiveness: if any number can be computed by an organism, it is computable by these definitions, and conversely” [1,p.113].

McCulloch and his young collaborator Pitts were, thus, the originators of today’s widely supported “computational model of the mind.” Their work inspired theories of “cellular automata,” in which individual cells live or die according to inputs from their surrounding cells, such as John Conway’s “Game of Life” and the hypergraphs of Stephen Wolfram’s *Mathematica*. Their work was central to the thinking of Claude Shannon, John van Neumann, and Turing as they formulated the architecture of the first digital electronic computers.

We review Three Recent Books on Artificial Intelligence, the Computational Model of the Mind, and the “Hard Problem” of Consciousness

Federico Faggin, author of *Irreducible: Consciousness, Life, Computers, and Human Nature*, is the computer scientist at Intel who, in 1971, designed the first microprocessor (the four-bit Intel 4004) and the MOS field-effect transistor and silicon gate technology that is the forerunner of all the computers on a single silicon chip up to today’s Nvidia chips that are the basis for the large language models of AI [3]. Every artificially intelligent machine is made of silicon parts. In *Irreducible*, he writes “Quantum reality... contains entanglement, a mysterious property that connects the quantum state (particles) ‘from within’ regardless of their distance. This implies a holistic reality made of parts that are not completely separable” (p.121).

George Musser, author of *Putting Ourselves Back in the Equation: Why Physicists Are Studying Human Consciousness and AI to Unravel the Mysteries of the Universe*, is a contributing editor at *Scientific American*, best known for his book on quantum entanglement, *Spooky Action at Distance*. In his new book, “entanglement takes two or more particles and makes a single larger structure out of them... Strictly speaking, there aren’t “parts” anymore... And if you can do that with conscious experience, you will ensure that a single mind results” (p.208).

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Christof Koch, Author of *Then I Am Myself the World: What Consciousness Is and How to Expand It*, was the president and chief scientist of the Allen Institute for Brain Science in Seattle and a cognitive neuroscientist best known for his work on the neural basis, the so-called “neural correlates,” of consciousness. In his latest book, he calls the prospect of machine consciousness “the burning question of the day.” He speculates on page 11, “Can technology provide us with the means to defer death?” “Mind-uploading will only be achievable if computational functionalism, the metaphysical assumption that computations, executed on a computer, are sufficient for consciousness.” Finally, he writes (p.191), “After all, isn’t it true if all the biophysical and biochemical mechanisms that the brain follows are properly codified, then the simulated brain must exude simulated feelings. How could it be otherwise if there is no spooky substance, no soul, no ghost in the machine.”

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