BOOKS: COMPUTERS

How Human Can They Get?

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Since its beginnings in the work of Alan Turing, the British mathematical genius who conceived of the computer, artificial intelligence has been overly anthropocentric. Its traditional—some would say misguided—aim has been to build machines that are like humans. For example, the Turing test for machine intelligence holds that a computer is a genuine thinker if it resembles a human being to the degree that someone interviewing both the computer and a human by teletype cannot tell which is which. Against this background, it is not surprising that researchers in artificial intelligence often make believe that their inventions possess human qualities. Turing himself described a simple computational mechanism as a "child-machine," to be "rewarded," "punished," and taught by a process intended to produce "discipline" and "initiative." Turing's child-machine was a "creature" that was taught by an "inspector of schools" but could not be sent to school "without the other children making excessive fun of it" (*1*). In a contemporary example, Daniel Dennett states that Cog, a robot under construction at the MIT Artificial Intelligence Lab, is to have an "infancy and childhood." Cog has "hips" and a "waist," and will have skin and a face. Cog is to be "as human as possible in its wants and fears, likes and dislikes." It will "want to keep its mother's face in view" and is to "delight in learning, abhor error, strive for novelty, recognize progress" (*2*).

The Age of Spiritual Machines
When Computers Exceed Human Intelligence
by Ray Kurzweil
Viking, New York, 1999. 400 pp. $25.95. ISBN 0-670-88217-8.

Ray Kurzweil is another who anthropomorphizes machines: nanomachines (devices built on an atomic scale) have "brains," "bodies," "arms," "hands," and "little fingers." His new book, *The Age of Spiritual Machines*, is an excellent example of the blurring of fact and fiction so common in discussions of artificial intelligence. He blends together present-day technologies, such as artificial legs and breast implants, with those he foresees, such as computers that store "migrated" human brains. Kurzweil predicts that computers will rapidly become more intelligent than human beings and will go to church for meditation and prayer. Humans, in contrast, will spend their leisure time in sophisticated virtual environments (often devoted to virtual—for Kurzweil, "better"—sex). Computational advances will ensure, he claims, that by 2029 the "basic necessities of food, shelter, and security are available for the vast majority of the human population" and "many of the leading artists are machines." Kurzweil contends that initially humans will use neural implants to extend their cognitive and perceptual abilities, but by the end of the 21st century they "will be software, not hardware" and will "port" their minds to personal computers before their bodies disintegrate.

The history of artificial intelligence is littered with the wrecks of fantastical predictions of machine capabilities and, in consequence, with grant applications rejected by eventually disenchanted funding bodies. Make believe infiltrates actual engineering projects—why else is Cog to have a "face" and a "mother"? Too often make believe replaces discussion of basic conceptual issues. For example, Kurzweil begins by describing evolution as "intelligent" and "a master programmer" (and from here it's only a short step to talk of "spiritual" machines). But this is to beg the very question at issue, whether or not human qualities can be applied to the inanimate. Another fundamental issue that Kurzweil ignores: What, exactly, is a computer? He offers only the vaguest of definitions. A computer, he says, is a machine that implements "a sequence of rules and instructions that describes a procedure to solve a problem." Equipped only with this characterization, it is easy to assume—as Kurzweil does—that brains are computers. But whether this is true is actually a scientific question, not one to be settled by semantics.

Who is the artist? This portrait was painted by "Aaron," a computerized robot built and programmed by Harold Cohen.

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Kurzweil makes it clear that he intends his speculations about the future to be taken seriously, and his professional credentials—as a highly successful inventor of computer technologies—are impressive. His basis for these speculations is a review of the history of computing and of fundamental questions in the philosophy of mind. But Kurzweil is no historian. For example, he states that the first operational computer was the Robinson, used against the German Enigma code in World War II. In fact, the Robinson was never used against Enigma, but against Fish (a completely different type of code). And in any case, Kurzweil appears not to know of the various electronic data-processing devices Flowers built for the British Post Office before the war. Kurzweil claims that the first stored-program computer was Wilkes' EDSAC in 1949 and that the first commercially marketed computer was Eckert and Mauchley's UNIVAC. The first electronic stored-program computer, however, was actually the Manchester Baby (June 1948), and the first commercially marketed electronic digital computer was its derivative, the Ferranti Mark I. The first Ferranti was installed in February 1951 and the UNIVAC two months later—not in 1950 as Kurzweil claims (*3*).

Nor is Kurzweil a philosopher. His account of Ludwig Wittgenstein, arguably the most important Western philosopher of the 20th century, is typical. Kurzweil writes that one of the primary theses of Wittgenstein's *Tractatus* "is that the human brain is subject to natural law," and in defining logical positivism he tells us that "analytic" means "deducible from observations." He also says that Wittgenstein's *Investigations* was, like *Waiting for Godot*, "of major importance to modern existentialism." Actually, the *Tractatus* says nothing about brains; every first-year philosophy student knows that analytic statements are opposed to those deducible from observation; and the *Investigations* influenced linguistic philosophy, which is the antithesis of existentialism. Kurzweil's account of the present and recent past in *The Age of Spiritual Machines* inspires little confidence in his imaginings about the future.

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References and Notes

1. A. M. Turing, in *Machine Intelligence*, vol. 5, B. Meltzer and D. Michie Eds. (Edinburgh Univ. Press, Edinburgh, 1969), pp. 3–23; *Mind* **59**, 433 (1950).
2. D. C. Dennett, *Kinds of Minds* (Basic Books, New York, 1996); *Philos. Trans. Roy. Soc. London Ser. A*, **349**, 133 (1994).
3. I am indebted to J. Copeland for the historical details.