

**John von Neumann and Norbert Wiener: From Mathematics to the Technologies of Life and Death.** by Steve J. Heims. M.I.T. Press. 547 pp. \$19.95.

Heims has a thesis and presents the lives of two mathematicians as an illustration.

John von Neumann (1903-1957) was perhaps the brightest of a remarkable group of Hungarian born mathematicians and physicists. Heims describes his contributions to mathematical logic, to the mathematical foundations of quantum mechanics, to the theory of games, to the development of computers, to the development of atomic bombs and peaceful nuclear energy, and to the relation of brain and computer.

Von Neumann's enormous popularity and reputation also came from his willingness to listen to other scientists and his ability to clarify their ideas and often solve the problems they were posing. No-one else then or since had anything like his reputation for this, but he might have made greater original contributions had he been less helpful to others.

Norbert Wiener (1894-1964) was child prodigy intensely educated by his father, a professor of languages at Harvard. He received his PhD at 18 and immediately began a career of contributions to many branches of mathematics. After World War II, he proposed a science of "cybernetics, the theory of feedback and control in animal and machine".

Wiener stories are often about his constant solicitation of assurance that his contributions to mathematics were outstanding - which they were. Although he was inclined to pontificate and had a higher opinion of the importance of some of his contributions than many others did, his two volumes of autobiography are usually very objective, especially about his earlier life.

In the late forties, Wiener and von Neumann shared an interest in the relation of computers to the brain, met often, and jointly organized meetings. Wiener's approach was through the notion of feedback, wherein the output of a process was compared with a goal and the difference used to control the process. He coined the term cybernetics for the whole field. von Neumann began to construct a "general logical theory of automata" and produced some fragments including a way of constructing reliable computers from unreliable components and a theory of self-reproducing machines.

While Heims doesn't attempt to evaluate the subsequent influence of the work of either Wiener or von Neumann, neither cybernetics nor the general theory of automata has been as successful as the approach first proposed about 1950 by the British logician and computer scientist Alan Turing. Tur-

ing proposed that mental processes be studied by programming a computer to carry them out rather than by building machines that imitate the brain at the physiological level. Programming concrete mental processes such as learning and heuristic search in connection with problem solving programs has proved more fruitful in psychology, computer science and the philosophy of mind.

When the first conference on artificial intelligence was organized for the summer of 1956, everyone had great hopes for a contribution from von Neumann, but he was already too sick.

Both men were interested in human affairs. von Neumann developed a mathematical theory of an expanding economy in the 1920s and a theory of games in the 1940s for studying competition and conflict. Both theories are still being applied and extended. He was alarmed by Soviet expansionism after World War II and advocated a strong U.S. military position including the development of the hydrogen bomb to which he also made technological contributions.

Wiener proposed that there be a cybernetic theory of human biology and sociology emphasizing both random processes and stabilization by feedback. These attempts achieved considerable acclaim, but (I think) few results of lasting value, because significant problems require more than just the ideas of feedback and filtering. Perhaps because he didn't see the problems of pattern matching and heuristics, he expected automatic factories to replace most manual labor before 1970. He worried about the expected unemployment but had few concrete proposals. His attitude to defense was the opposite of von Neumann's; he opposed work on defense problems after the end of World War II, sometimes holding that a scientist should keep secret work that he thought could be used for military purposes.

Heims's thesis is that Wiener was moral and von Neumann was immoral in their attitudes toward the uses of science, especially military applications, but also industrial. Aspects of their family backgrounds, early work, and personal lives are interpreted as precursors of their postwar positions. The "critical science" style he adopts involves loaded adjectives and other unfairness and often assumes what he has undertaken to prove. Thus Truman's decision to use the atomic bomb is ascribed solely to a desire to intimidate the Soviet Union, and Eisenhower's 1955 atoms-for-peace proposals are described as a "benign veneer". Both propositions are unsupported by argument. The series of photographs ends with two of deformed Japanese babies. Like the curate's egg, parts of the book are good.