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BOOK REVIEW

Norbert Wiener 1894–1964, by P. R. Masani,* Birkhäuser, 1990, 416 pp. ISBN 3-7643-2246-2

Norbert Wiener: a precocious genius whose father once shook him by the shoulders and told him if he ever amounted to anything, the credit belonged to the father; who fostered a naive *enfant terrible* image, for example ostentatiously reading popular magazines while sitting in the front row of joint Harvard/Massachusetts Institute of Technology seminars; who was so unsure of himself that his M.I.T. colleague and former student Levinson had as one of his duties to assure him frequently that he was a fine mathematician; so naive in his need of appreciation that he had the habit of asking other mathematicians what he was, a mathematician, an engineer, or a statistician—the desired answer was, of course, 'all three'; who on the other hand was self-assured enough to write to Hitchcock, the great director of suspense movies, offering to send him a movie plot; who felt himself so far out of the science establishment that he resigned from the U.S. National Academy of Sciences; so isolated that he stalked the halls at American Mathematical Society meetings peering nearsightedly to find a friendly face; so estranged from humanity that he wrote a novel whose principal character was an unorthodox genius who finally killed himself in despair at his lack of appreciation by his colleagues (themselves readily identifiable living mathematicians, thinly disguised by pseudonyms, and so unhappy at their book characterizations that they influenced publishers to reject the novel); whose feeling for physics and appreciation of Lebesgue integration was so deep that he was the first to understand the necessity of and the proper context for a rigorous definition of Brownian motion, which he then devised, going on to initiate the fundamentally important theory of stochastic integrals; who, however, was so unfamiliar with the standard probability techniques even at elementary levels that his methods were so clumsily indirect that some of his own doctoral students did not realize that his Brownian motion process had independent increments; who was the first to offer a general definition of potential theoretic capacity; who, however, published his probabilistic and potential theoretic triumphs in a little-known journal, with the result that this work remained unknown until too late to have its deserved influence.

Wiener's treatment of prediction theory illustrates his distinctive approach to science and its applications. In 1920, Szegö solved a problem of complex polynomial

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approximation in the mean square sense on a circle. In 1939, Kolmogorov generalized Szegö's result in the probabilistic context of prediction theory for stationary stochastic processes. A little later, but independently, Wiener solved Szegö's problem in the prediction theory context, but his work stressed derivation of explicit predictors and the application to cybernetics, his coined name for the theory of control and communication.

The importance of Wiener's work in logic, harmonic analysis, electrical engineering, probability and potential theory is now accepted. His contributions to physiology and social affairs are somewhat questionable. He always thought on a grand scale, and stressed the adaptation of technical concepts from pure mathematics (for example, stationary stochastic processes) and electrical engineering (for example, feedback) outside their technical contexts. Masani handles the problem of Wiener's sometimes naive or foolish utterances very neatly, in a Wienerian approach: one must sometimes filter Wiener noise out of a Wiener signal to find the message.

Masani's interesting and thoughtful book analyses both Wiener's mathematical and his nonmathematical ideas in sympathetic and sensitive detail, rising sometimes to Wiener's own cosmic level. The following penultimate paragraph of this book gives its flavour and exhibits the extraordinarily high role Masani assigns to Wiener's contributions to modern thought.

> Wiener understood the scientific and philosophical implications of Bergsonian time and the Second Principle of Thermodynamics more fully than any other thinker. A unique and significant aspect of his writings is the underlying thought that the contingent cosmos that modern physics reveals is worthy of the Pythagorean attitude that Einstein expressed in the words 'Intelligence is manifested throughout all Nature'. He also realized that the entropy principle has a moral dimension, that evil is like physical noise in its persistency and noneradicability. Thereby he showed that the contemporary belief in unlimited progress has no basis in science, and that the reflections on the problem of evil of our great religious predecessors can be absorbed into a scientific framework. This is perhaps the first significant dent in the schism between science and religion that has reigned during the last 300 years—a schism which Whitehead regarded as the source of much that is 'halfhearted and wavering' in modern life [W8, p. 94]. Wiener's contribution was to show that the Gibbsian conception of the universe allows the precise demarcation of the concepts of contingency, purpose, freedom and entropy in stochastic terms. We may regard him as the first scientist-philosopher of the stochastic age. His thought firmly suggests that the calculus of probabilities has to become an integral tool in the philosophy and theology of modern man.

Readers who are willing to follow ideas at this level and to appraise Masani's justification of this extraordinary evaluation of Wiener's contributions will find much to appreciate in this book, in addition to the discussion of Wiener's technical research.

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