The Inner Turbulence of Genius: Norbert Wiener

Dark Hero of the Information Age: In Search of Norbert Wiener. *By Flo Conway and Jim Siegelman, Basic Books, New York, 2004, 423 pages, $27.50.*

BOOK REVIEW
By Philip J. Davis

In reviewing this biography of Norbert Wiener—the fifth to appear, by my count, which includes Wiener's two autobiographies—I thought that the man, his work, his legacy would be so well known to readers of *SIAM News* that I could get away with discussing only his political and humanistic beliefs and actions. But no. When I put the matter to a longtime SIAM member, he disabused me of this opinion, quoting the Book of Exodus—"And there arose a Pharaoh who knew not Joseph"—and then amplifying the quote by pointing out that younger people, born after Wiener's death (in 1964), know the name only as a descriptive adjective. This being the case, I begin by recalling a few of the adjectival usages.

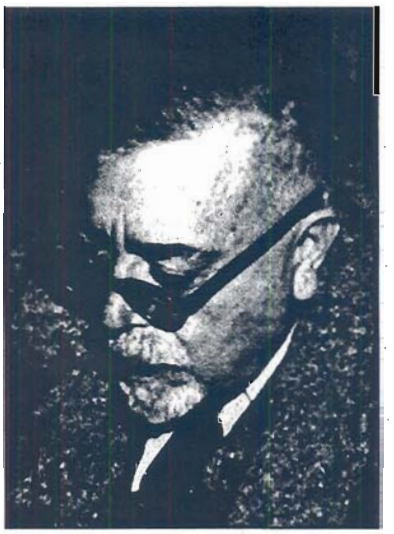
We have the wiener process—and I use the lower-case "w" as befits theories that have attained the mathematical Valhalla—we have wiener measure, the wiener integral, the wiener–hopf equation, paley–wiener theorems. Have I forgotten anything? Well, let me add the wiener extrapolation of linear time series, his generalized harmonic analysis, and his work on tauberian theorems, and then let's ask the question again.

It was Wiener who gave the word "feedback" its current mathematical twist, who put the word "cybernetics" into our current vocabulary, to the extent that every child who watches TV or plays with a computer seems to know who the cyborgs are and what role they play in cyberspace. I've even seen fast food shops advertising "cyberburgers," without any accompanying definition as to what they might be. Were Wiener to return to earth, he would be revolted by this commercialization of the neologism he invented.

Despite these fundamental contributions to pure and applied mathematics, the human being from whose brain these ideas sprung remains vaguely known. Even the publisher, in a dustjacket blurb, admits that the passage of time has mossed over Wiener's image:

"Award-winning journalists Conway and Siegelman [have] set out to *rescue* Wiener's genius from *obscurity*." (My italics.)

If you are looking for formulas and theorems, I suggest Masani's 1989 *Norbert Wiener*[1]. If you are looking to learn how Wiener and von Neumann stack up against one another (Wiener = analog; von Neumann = digital), I suggest an earlier book by Steve Heims[2] (although the balance between the digital and the analog has shifted since the book was written). But if you are looking for the flesh-and-blood Wiener, you will find it here—not just Wiener the tremendous brain, Wiener the icon, Wiener the gauche and eminently laughable eccentric (as we unfeeling students thought of him). Or Wiener the short, stocky man, bearded in a day when few had beards, waddling through the halls of MIT popping peanuts. If you are looking for the human face of the man, then I highly recommend the book under review. There are



A new biography looks beyond Norbert Wiener "the tremendous brain . . . the icon . . . the eccentric" to the "flesh-and-blood Wiener."

dozens of Wiener anecdotes floating around, some of them true; if, dear reader, you wish to augment your personal stock, you will find stories here in abundant measure. (SIAM managing director emeritus I.E. Block shares a few of his own favorites in the accompanying sidebar.)

Flo Conway and Jim Siegelman, journalists who have written about psychological and social issues, worked on this book for eight years. As biographers, they had the advantage of access to new archival material, as well as cooperation from Wiener family members, in terms of both personal interviews and access to the Wiener family records. What emerged from their labors is Wiener as a prodigious brain and—yes—eccentric, but also Wiener the rebel, the quarry of the McCarthy witch hunters, the humanitarian, and the family man living with a somewhat paranoid wife who had strong totalitarian political and social tendencies.

We read about Wiener the tormented manic depressive, the man avid for love, and jealous and zealous with respect to his reputation on earth and his ultimate position in the pantheon of science. But the man portrayed by Conway and Siegelman also shared, without stint, his path-breaking ideas with the scientific community. We read, too, about Wiener the seer, the prophet, the polemicist, the novelist.

Here also is Wiener the self-promoter. He sought to catch the eye of Hollywood with his novel *The Tempter*, whose plot is based on the story of Michael I. Pupin of Columbia University, who got all the fame and money from an invention that Oliver Heaviside had patented, leaving Heaviside in obscure poverty. Wiener was always for the oppressed, but Hollywood decided (I'm sure accurately) that little money could be made from a drama about competing claims to a scientific idea. Would the story have been picked up if Wiener had gratuitously added a femme fatale? Ah yes, the desire for fame is frequently seductive.

Another episode recounted by Conway and Siegelman is the sudden breakup of the collaborative group comprising neurobiologist Warren McCulloch (1898–1969), mathematician Walter Pitts (1924–1969), a brilliant autodidact, and neuroscientist Jerome (Jerry) Lettvin: three bright planets revolving around Wiener The Sun. This catastrophic break was instigated by Wiener, suddenly, without warning. It led to a long depression for McCulloch and to the total collapse and disintegration of Pitts. What brought on this discontinuity? I believe that Conway and Siegelman have told the story in print for the first time, and I leave the curious to satisfy their inquisitiveness by reading what the authors unearthed.

Did I read about other aspects of the life of Norbert Wiener, the man, that I was not aware of before? Certainly one such aspect is the intensity of his psychological ups and downs, described here in almost embarrassing detail. Could Wiener's behavior be characterized as Asperger's syndrome? Lists of candidates for Asperger's are long. Dr. Asperger (Vienna, 1944) himself thought that to succeed in mathematics one needs a touch of it.

I turn finally to Wiener the Rebel and Wiener the object of the FBI's hostility during the post-World War II McCarthy era (1947–1954). Though I knew a number of mathematicians and scientists who had been severely harassed, I had not realized until I read the two chapters the authors devoted to this period that Wiener was among them. The story, briefly, is this. Wiener thought about all things with extraordinary—almost debilitating—intensity. Early on, after the end of WWII, he resolved that he would not carry on any military-connected research. He stuck rigidly to this resolu-

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[1] *Norbert Wiener, 1894–1964*, Birkhäuser, 1989. See also my review, "Modesty Is Not a Virtue: Norbert Wiener," *SIAM News*, February 1995; http://www.siam.org/siamnews/bookrevs/davis295.htm.

[2] *John von Neumann and Norbert Wiener*, MIT Press, 1980.

I Remember Well

The Subject: *Norbert Wiener, Professor of Mathematics, MIT*

The Setting: *Graduate School at Harvard, with Classes at MIT*

The Time: *Circa 1950*

I remember well, if not always perfectly, my days as a graduate student at Harvard. Phil Davis was there at the same time, and occasionally we would audit courses at MIT (Levinson, Pitts, and Wiener, and possibly others).

I especially remember a course that Wiener gave, on material in Paley–Wiener (*Fourier Transforms in the Complex Domain*), in the late morning, once or twice a week. The course was inspiring and exciting, mostly because of Wiener's great wisdom and depth of thinking about real topics in the then evolving world of technology and medicine.

Wiener was a sensitive man, seemingly alone in his own world, but (maybe) very much in touch with his surroundings when a subject captured his interest. The stories about him that circulated among us grad students in those days were numerous. Here are a few of them—some true, others maybe not so true.

Visit to Brown

On Thursday afternoons, Wiener traveled to Brown to attend Brown's regular monthly seminar. Notwithstanding his poor eyesight, he sometimes drove; other times he took the train or got a lift. One time he forgot that he had driven and returned home by train. It wasn't until the following Saturday that he went to his garage for his car and discovered it missing. He reported the theft to the police. Several days later it turned up in a Brown parking lot.

From Classroom to Classroom at MIT

Wiener's schedule sometimes included two classes, back to back. To avoid wasting time, he would read a paper or book while walking from one classroom to the next. Holding the paper in one hand, he would use a finger of the other to guide himself through hallways and around corners. Instructors knew to keep classroom doors shut so that Wiener could pass by. But more than once, encountering a door left open, Wiener proceeded into the classroom and passed around the four walls, finally reaching the door again and continuing on his way.

On the Way to Lunch

Wiener often walked from his office to the MIT faculty dining room for lunch, sometimes stopping to chat with students on the way. At the end of one such conversation, he asked the student which way he had been going when they met. The student pointed toward the dining room. Wiener said: "Fine, I haven't had lunch yet" and proceeded toward the dining room.

The Proof

It was a theorem in Paley–Wiener's *Fourier Transforms in the Complex Domain*, maybe a Tauberian theorem. Wiener went through the proof in his lecture. Part way through, a student pointed out an error Wiener had made and asked him about it. Wiener looked at the proof for about five minutes, agreed with the student, and promised to correct it at the next class. True to his word, in the next class Wiener started over on the proof. When he reached the point of the error, he made exactly the same error and proceeded to finish the proof. Q.E.D.

Sleeping in the Front Row

Wiener had a reputation for sitting in the front row and falling asleep during colloquium lectures. Invariably, at the end of a lecture, he would awaken and ask a relevant question about some aspect of the lecture.

Then there was the AMS session at the University of Chicago (or maybe it was at MIT). The participants, John von Neumann, N. Rashevsky, and Wiener, were seated side-by-side on the stage. Rashevsky had a long red beard, forked at the end, which he constantly stroked to pull it together. Von Neumann, as he habitually did in such settings, talked to himself as each of the others spoke. Wiener, as usual, slept through the others' talks.

Thesis Topics

A student had been accepted by Wiener as a PhD candidate. The student had requested a topic having to do with interpolation, extrapolation, and smoothing of time series. Wiener agreed to the request and made a date with the student to frame the topic. A week later, an excited Wiener proposed a topic in number theory, far from the student's interests. The student politely excused himself from the project.

To end more respectfully, here is a note on Wiener, attributed to SIAM, that appears in the front matter of *Selected Papers of Norbert Wiener*, 1964:

"Professor Norbert Wiener (1894–1964) believed that significant research topics are to be found in the 'crack' between two fields. Motivated in this way, he spent much of his life in areas bordering on electrical engineering, physics, and biophysics. His exceptional intuition and profound understanding of mathematics exhibited to him a unity where previously only diversity had been in evidence. It is to his initiative and genius in elucidating these complex structures that the present volume is dedicated."

—I.E. Block, Managing Director Emeritus, SIAM.

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tion. We all knew that this was the case. Most mathematicians respected his choice and then went off and did what they wanted to do.

As a student in Cambridge at the time, I had very limited interaction with Wiener. I used to see him at colloquia and meetings. On November 28, 1949, in the Macmillan Auditorium of Columbia University, Wiener gave the 23rd Gibbs Lecture of the American Mathematical Society. I expected something like a discussion of tauberian theorems or generalized harmonic anaysis. But Wiener had other priorities. In a talk titled "Problems of Sensory Prosthesis," he described the use of feedback mechanisms in the construction of artificial limbs. Here, indeed, was mathematics turned to human values. I was sitting in the first row, next to Bob Finn (Stanford University), taking it all in. I don't recall Wiener writing a single equation on the blackboard behind him. He strutted back and forth on the platform, talking away and ignoring a heckler in the gallery who, midway through the lecture, called out, "Wiener, where's the mathematics?"

Ed Block and I audited one of Wiener's courses in the spring of 1950. Wiener would pause in the middle of writing an integral on the blackboard and rail against the media for all the misinformation and trash they were publishing. I have learned from the book under review that his spirits were then at a very low point.

Wiener warned against allowing the computer to become a Golem, a device that, once started, cannot be turned off, come what may. He predicted, based on his cybernetic outlook, that rigid, top-down political structures that allow no negative feedback—such as the Soviet Union—would face collapse. He maintained that society should not be based exclusively, as it seemed to him to be, on consumption, property, and money. In 1950 he came out with the book *The Human Use of Human Beings*, which aired these views. A half century after Wiener wrote, society has not yet found a way to heed his warnings.

Wiener subscribed to the notion that scientific information should be totally available. He would have found repugnant the current practice of mathematical formulas and codes being subject to royalties. But whose behavior is totally consistent? In late 1946, he refused to grant Boeing Aircraft access to his classified "Yellow Peril" manuscript.[5]

While holding these views, Wiener had a vast number of scientific and technological acquaintances at home and all over the world, whom he saw and corresponded with, regardless of their political or social orientations. It was almost inevitable that he should have found himself in the crosshairs of the Red hunters. Wiener, the naive dove, became a dossiered suspect. By the end of 1954, with the censure of Senator McCarthy, things quieted down considerably, and Wiener was in the clear. His years of anxiety are described here in some detail.

The authors not unreasonably call the present age Wienerian, but I prefer to call it the age of increasingly interpenetrating mathematizations. In so designating it, I include other geniuses and also the hundreds—nay, thousands—of scientists and technologists on whose shoulders their genius was brought to fruition.[6]

[5]"The Extrapolation, Interpolation and Smoothing of Stationary Time Series."

[6]Cf. *Legacy of Norbert Wiener: A Special Symposium in Honor of the 100th Anniversary of Norbert Wiener's Birth*, October 8–14, 1994, AMS.

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Mathematical Programming Symposium. It reached a far wider audience when *The New York Times* featured Khachiyan and his algorithm in a front-page story.

To put Khachiyan's result in perspective, the SIAG tribute cites the simplex method: "While the simplex algorithm solved linear programs well in practice, Khachiyan gave the first formal proof of an efficient algorithm in the worst case."

Khachiyan's analysis, the piece continues, "led to broad applications of the ellipsoid algorithm as a method for obtaining complexity results for discrete optimization problems. Khachiyan and co-authors also developed polynomial-time algorithms for convex quadratic programming, studied the complexity of polynomial programming over the reals and the integers, and devised the method of inscribed ellipsoids for general convex programming."

A full obituary, recognizing the diversity of the areas in which Khachiyan made substantial contributions, in collaboration with many other researchers, will appear in a future issue of *SIAM News*.

As to George Dantzig, mention of his name as the developer of the simplex method would have been superfluous in a piece directed to the optimization community—and probably to most readers of *SIAM News* as well. Dantzig, in fact, is so well known to the optimization community that the editors of *SIAM Journal on Optimization*, in dedicating the first issue to him, found that they needed very few words: "The first issue of the *SIAM Journal on Optimization* is dedicated to George Dantzig who has been so influential in the development of optimization." The sad news of Dantzig's death came at press time for this issue of *SIAM News*; an obituary will appear in a subsequent issue.

B. Curtis Eaves, long-time professor of operations research at Stanford, captured the extent of the loss in a message to friends and colleagues: "George has been with us as if forever, so important for so long. It will take some getting used to, to accept that he is no longer with us. As I have said before, George is the most important, generous, and extraordinary person I have had the privilege of knowing."