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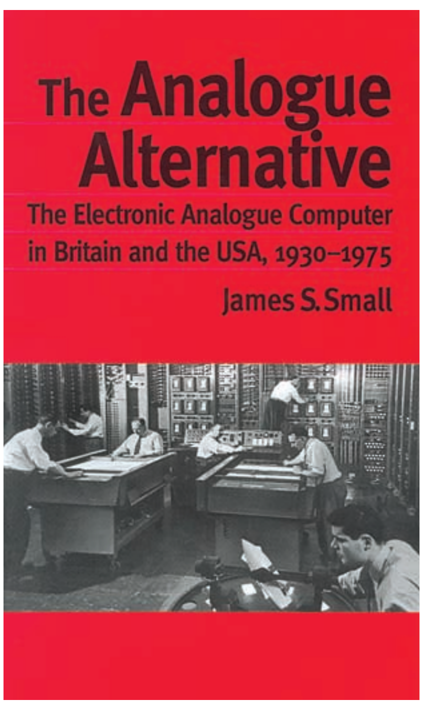
The Analogue Alternative, by James S. Small, Routledge, 2001, 322 pp., £70, ISBN 0-415-271193.
From Newspeak to Cyberspeak. A History of Soviet Cybernetics, by Slava Gerovitch, MIT Press, 2002, 369 pp., $37.95, ISBN 0-262-07232-7, *Reviewed by Chris Bissell.*

When I was a student in the 1960s, any introduction to "computing" differentiated between analog and digital computers and explained the difference. These days, the contribution of analog computers to technological developments in the mid-20th century is largely unknown to younger engineers. James Small's *The Analogue Alternative* is an extremely valuable contribution to the history of computing—and the history of information engineering in general—and it should play a valuable part in bringing to the attention of a wider readership what one historian of technology has called "one of the great disappearing acts of the twentieth century."

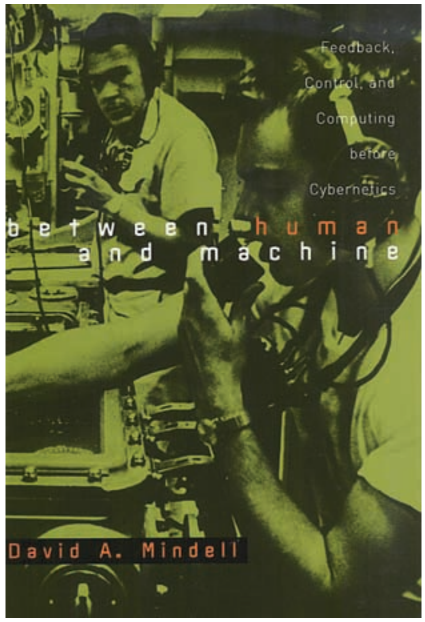


The author begins by reviewing analog computing devices in the 19th and early 20th centuries, discussing early ac network analyzers and the development of mechanical network analyzers in the United States and the United Kingdom, in particular the pioneering prewar work of Vannevar Bush at MIT and Douglas Hartree in Manchester, UK. The heyday of the analog computer, however, was in the postwar period, when analog and hybrid computers lay at the heart of military and civil research and development in aeronautics, process control, nuclear engineering, and elsewhere. A detailed discussion of this makes up the bulk of this valuable book. James Small makes a convincing case that the analog electronic computer should not be seen as a natural development of earlier mechanical devices; indeed, the postwar centers of excellence were quite different from those of the prewar machines. Furthermore, he argues, there emerged a distinct postwar analog computer industry and community of users, which grew steadily until the mid-1960s and only later declined.

Those interested primarily in technical information will find a wealth of information on such classic machines as Typhoon and the RAND analog computer, as well as later commercial machines from a wide range of companies in the United States and the United Kingdom. But there is also a fascinating sociotechnological discussion of the role of analog computers in engineering culture and engineering design, as well as the polemics of the analog-versus-digital debates of the 1950s and 1960s, debates and conflicting claims over speed, accuracy, and precision, for example. As Small notes, the development of analog computers was "a process involving technical and economic imperatives, military agencies, civilian and government bodies, commercial companies, universities, private firms and research institutes." He handles this complexity with a thorough understanding of the contingencies of technological change; the result is a fascinating read of great interest to both practicing engineers and historians of technology.

If analog computing is an example of the sociopolitical context of technological change, then the history of cybernetics is even more so. Even in the West, cybernetics has had a contested history, but when we turn to the former Soviet Union we find a fascinating story of the interplay of technology, mathematics, ideology, and politics. Slava Gerovitch's study of Soviet cybernetics, *From Newspeak to Cyberspeak*, makes this story accessible for the first time to a wide readership. In the early days of cybernetics, following on from the pioneering work of Wiener and others, the ideas were criticized in the Soviet Union, being labeled as a "pseudoscience" (a term that has a much stronger resonance in Russian, both politically—being part of the vocabulary of the State—and linguistically, using the native prefix meaning "lying" rather than our Greek euphemism). Gerovitch has quite a lot to say about language, which makes extremely interesting reading, but the most valuable part of this book is the reporting of his thorough research in the archives of the former Soviet Union that have only recently been available to scholars.

During the Khruschev era, cybernetics was more than reinstated. In the late 1950s and early 1960s it became enormously influential and all encompassing. A proposal for a Soviet Institute of Cybernetics included the subjects logic, control, statistics, information theory, semiotics, machine translation, economics, game theory, biology, and computer programming. By the following decade, however, cybernetics had become “a convenient tool of bureaucracy.” Gerovitch tells an intriguing story: “It [Soviet cybernetics] was contested, fought over, reshaped, and put into service by various groups with diverse interests and political agendas.... The military and pacifists, technocrats and environmentalists, dissidents and Party bureaucrats alike spoke the language of cybernetics.” But Gerovitch’s story is not only an outstanding history of Soviet cybernetics. Both his book and Small’s, on the history of analog computing, delve deeply into the complex environment within which technologies are created, come to maturity, and, in some cases, decline. They invite us to reflect on technology in our own time.



Between Human and Machine: Feedback, Control and Computing before Cybernetics, by David A. Mindell, Johns Hopkins University Press, 2002, 256 pp., $46, ISBN 0-8018-6895-5. *Reviewed by David L. Elliott.*

Today automatic control and communication are intertwined, based on such mathematics as Norbert Wiener’s work on filtering and prediction. However, their development and relationships between the world wars is far richer than such hindsight suggests. In *Between Human and Machine*, David Mindell explores the period from 1916 to 1948, raising many questions and providing interesting answers. Why was Wiener asked to look at the problem of tracking aircraft? Why do the controls of the 200-in telescope on Mount Palomar look like a gun director? What did “stability” mean to Harold Black? Who first conceived of the PID controller? Why did early antiaircraft gun controls work at all?

David A. Mindell worked as a control engineer at Woods Hole Oceanographic Institute on the design and use of telerobotic vehicles for undersea exploration and later studied the history of technology at MIT. In this text he examines the founding myths of control engineering and sheds considerable light on its people, companies, and ideas. “The first half of the book.” writes Mindell, “follows four technological traditions of control systems: the U.S. Navy Bureau of Ordnance and its fire control contractors, the Sperry Gyroscope Company, the Bell Telephone Laboratories, and Vannevar Bush’s laboratory at MIT… In each of these settings … engineers had differing conceptions of what constituted a system, the role of the human operators, and how machines represented the world.” The second half covers the convergence of those four technological traditions and their transformation during World War II.

Here are Hannibal Ford, Elmer Sperry, Vannevar Bush, and the electromechanical navigation and gun direction computers built for navigators, pilots, and artillerymen. The components included gyrocompasses, synchros, differential gears, ball-and-disc integrators, and all the cranks and dials that are seen now only in cartoons. In many devices the outer feedback loops were closed by human operators. The illustrations are helpful, including photographs, signal flow diagrams, and line drawings. The latter include wonderful sketches by Sperry Gyroscope Company’s Alfred Crimi showing the relation of the gunner to the machines in an aircraft ball turret. Sperry, a company that specialized in control systems as discrete technology, is described in Chapter 3.

The Bell Laboratories chapter includes a careful analysis of the contributions of Harold Black, Harry Nyquist, and Hendrik Bode to the concepts of negative feedback and stability. To Black, stability originally meant what we would now call insensitivity or robustness in the presence of a variable environment. Stability in the sense of Routh and Hurwitz was the concern of engine designers and mathematicians such as Nicholas Minorsky, the progenitor of the three-term controller. At Bell Labs its relation to Nyquist’s work was understood.

The MIT mechanical differential analyzers, first used to implement artillery firing tables, became differential equation solvers in the hands of physicists and mathematicians. Their flow diagrams were inherited by the electronic analog computers of the 1950s. *Between Human and Machine* has chapters on the wartime work at MIT of the Servo and Radiation Labs, in conjunction with Navy bureaus. The problem was to direct large gun turrets with small electric signals, and as a consequence an MIT graduate, Edward Poitras, designed the system of motors, selsyns, feedback loops, and manual controls for the Palomar telescope.

Chapter 7 is also concerned with the fire control research sponsored by the National Defense Research Committee on the antiaircraft problem. The antiaircraft guns of the Allies in World War II were successful for three reasons: bombers, setting their bombsights, had to fly straight; radar