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member states of the ESA and agreements with other space programs such as NASA. The authors make a good case for the relevance of the history of the ESA for the future of space science, and could make the argument even stronger. In an era in which management of research is an increasingly competitive, complex, and global enterprise, international cooperation in R&D will only become more important, not only among states, but also among universities and private firms.

Jon Guice

Edwards, Paul N. *The closed world: Computers and the politics of discourse in Cold War America*. Cambridge, Mass: MIT Press, 1996. xx, 440 pp.

The closed world offers a counterpoint to the large but almost entirely internalist literature on the history of computing. It also develops a complex argument about the nature and determination of science and technology. Edwards treats "computers" as devices, concepts, research agendas, metaphors, and political symbols, among other things, and he traces the character of computers to multiple and diverse aspects of the cultural, political, and technical landscape. The result is an intricate account of the co-evolution of scientific thought, technology, geopolitics, and political institutions and culture, from the earliest development of computing in association with military organizations after World War II to the Strategic Defense Initiative in the 1980s. Case studies treat the origins of cybernetics, cognitive psychology, artificial intelligence, and the SAGE air defense system. A final chapter summarizes and extends the analysis with a review of computer science fiction through the entire period. We have a sweeping, kaleidoscopic view of some of the most important scientific and technological developments of our century, firmly grounded in contributions of the national security state.

Jon Guice

Forman, Paul, and Jose M. Sanchez-Ron, eds. *National military establishments and the advancement of science and technology*. Boston: Kluwer Academic Publishers, 1996. xiv, 340 pp.

Paul Forman's provocative paper, "Behind quantum electronics," *HSPS*, 18:1, on the military's shaping of American physics during the Cold War, among much else inspired the conference from which the volume under review resulted. The conference was notable for the diversity of countries examined (Britain, France, Germany, Argentina, Spain, and the US) but does not deliver the implied comparative analysis. Most of the papers, some of which have appeared elsewhere as well, concentrate on national contexts.

Attention to past perceptions of the relations between science, technology, and the military seems to unite the papers. David Edgerton's scathing scrutiny of the rhetoric of leading British scientists (and historians) leads him to

observe that “scientific intellectuals” typically vacillated, depending on the prevailing political currents, between claiming “pure” science’s peaceful nature and boosting its great contributions to military technology. Helge Kragh’s paper on the role of the military in the development of telephone systems makes clear how useless it often is to distinguish between civilian and military technologies. Michael Eckert contends that standard comparisons between the achievements of American and German nuclear weapons projects during World War II are misleading because they fail to recognize the divergent traditions governing the interactions between theoretical and experimental physicists in the two countries.

Bruce Hevly focuses on the making of instruments for ionospheric research at the Naval Research Laboratory in the interwar years. He argues that science and technology were not separate endeavors there but were integrated by the NRL scientists who transformed their tools of science into weapons of naval operations. Revisiting quantum electronics, Forman investigates the invention of the maser by Charles Townes at the Columbia Radiation Laboratory in the 1940s and 1950s, and, for good measure, gives a fascinating study of the evolution of the term “gadget.” The fact that Townes’s idea for the maser came in the context of contracting and consulting with the military indicates to Forman the significance of “secret discussions under national security auspices” for scientific advances during the Cold War.

Zuoyue Wang

Harrington, Anne. *Reenchanted science: Holism in German culture from Wilhelm II to Hitler*. Princeton: Princeton University Press, 1996. 309 pp.: illus.

To capture the course of German holism within the life and mind sciences from 1890 to 1945, Anne Harrington employs a group biography of behavioral biologist Jacob von Uexküll, clinical neurologist Constantin von Monakow, Gestalt psychologist Max Wertheimer, and neuropsychiatrist Kurt Goldstein. Harrington does not attempt to provide a detailed history of German behavioral biology or Gestalt psychology; instead, she gives a rich account of the integration of scientific, cultural, and political life in the holism espoused by her four subjects. Charting the course of these holists from the First World War through the cultural and intellectual crises of the Weimar period to the Nazi Era allows Harrington to move beyond the dualist opposition of wholeness and mechanism to a fuller understanding of the ambiguities and varieties of German holism and its association with Nazi science and culture. Harrington’s analysis successfully locates holism within German culture and raises important questions about the interconnections between scientific and political cultures.

Michael R. Dietrich