Ronald R. Kline, *The Cybernetics Moment: or Why We Call Our Age the Information Age*. Baltimore: Johns Hopkins University Press, 2015, 336pp. \$54.95.

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There is no question that war has led to some of the greatest technological developments and scientific advances for all of humankind. Many of the tools we use today are taken for granted, and some underestimate the contribution that military science and research have brought to enhancing the everyday lives of billions. The highly complex and ubiquitous Global Positioning System (GPS), for example, was once solely a military technology with limited availability. Today, nearly every modern smartphone bought and sold has the capability to access a shared satellite network for the benefit of businesses, governments, militaries, and consumers alike. From aiding the precision targeting of missiles to mapping the ocean floor to planning a bicycle route to and from work, GPS (first introduced in 1978) is now a staple of twenty-first-century life.

According to Robert Kline—historian of technology at Cornell University and author of two other volumes concerning society and technology—the problem of developing another military technology (albeit one less ubiquitous than GPS) set the stage for the conceptualization of the so-called “information age”: the automated anti-aircraft weaponry and control systems that emerged out of World War II. The pressing military need to understand control and communication systems that consist of human (organic) and machine (technology) elements led to envisioning the anti-aircraft gun, its human operator, and the highly mathematical targeting computer as a singular cohesive entity. This new way of thinking and looking at the world enabled a new conceptualization of organisms and machines (or technology) as information-feedback systems, each with varying methods of communication and control between internal components and the external environment. The study of these communication systems came to be known as cybernetics.

A more holistic understanding of cybernetics is expressed via (Kline’s) analogy “that the principles of information-feedback machines, which explained how a thermostat controlled a household furnace, for example, could also explain how all

living things—from the level of the cell to that of society—behaved as they interacted with the environment” (1). The earliest theories behind this concept were developed most notably by a pair of American scientists: Claude Shannon (1916–2001), an electrical engineer, cryptographer, and mathematician often dubbed the father of information theory (a staple building block of cybernetics), and Norbert Wiener (1894–1964), who defined and popularized the term “cybernetics” with his noteworthy text *Cybernetics* in 1948. Wiener made vast contributions to the field beyond its mathematical and quantitative origins, aiding its growth into fields of biology, computer science, neuroscience, and philosophy. To this day the language of feedback, control, transmissions, and signals (the language of cybernetics) is used in fields across the spectrum of electrical engineering to neuroscience to the social sciences.

The concept of the “information age” is a key aspect of this work—the very question of “why we call our age the information age” being posed in the book’s subtitle. Kline states his intent for *The Cybernetics Moment* to “examine the intellectual and cultural history of the information discourses of the Cold War . . . which celebrates how the merger of computers and communications is creating the next stage in American civilization: the information age” (5). In considering such terms as “information age,” “information society,” and “information economy” in both a historical and contemporary context, Kline acknowledges the problems they present to the language and discourse of scientists, journalists, policymakers, and others. He deliberately avoids debating whether such a label as “information age” is appropriate for our time, choosing rather to address *why* we believe our age is thus, and what it took to get where we currently are. Ideology and criticism, Kline admits, are not his milieu (at least not in this volume): *The Cybernetics Moment* is ultimately a work of history and historiography.

Kline informs with a wealth of literature, including numerous conference proceedings, letters, research papers, and documents originating from early cyberneticians who debated and discussed the theoretical and practical applications of their discipline throughout much of the mid-twentieth century. Of particular import are the Macy Conferences on Cybernetics held between 1946 and 1953, where such notable scholars as Margaret Mead, Gregory Bateson, and Warren McCulloch gathered to bring this new and growing discipline to the forefront of scholarship and society. Kline draws heavily upon the documentation resulting from these events and provides additional perspectives from such institutions as AT&T Bell Labs, MIT, and the Rockefeller Foundation, which supported cybernetic research at its height. These organizations provided funding and infrastructure to allow for experiments and innovations ranging from practical military applications, to Shannon’s experimental robot-like, maze-solving mouse, “Theseus,” to the homeostat—a cybernetic model

intended to mimic an organism's ability to adapt to environmental changes (i.e., to achieve homeostasis)—developed by W. Ross Ashby in 1949. A short article in a *Time* magazine from the same year posited it as “the closest thing to a synthetic brain so far designed by man.”

Technical and mathematical models are not the only aspects of cybernetics presented here. Kline also describes the social and popular culture influences of this new science, especially during its rise and decline in the 1950s and 60s. The impact of cybernetics on society is wider than one might think, and readers will come away with a well-rounded understanding of the science's influence on modern and contemporary theory and philosophy. Chapter 8, titled “Inventing an Information Age,” is a brilliant review and discussion of post-industrial era discourse (as forecasted by sociologist Daniel Bell in the work *The Coming of Post-Industrial Society*, 1951), and the commonly heard counter-narratives that frequently took more qualitative approaches, shunning Bell's alleged technological determinist approach. This chapter's impressive account of the divisive and complex narratives surrounding information, cybernetics, and the “information age” and its counter-narratives will be a boon to librarians and information scientists hoping to better understand the ideologies and narratives born out of the Cold War craze over cybernetics and information.

Kline uses clear wording and provides simple models to explain many of the complex mathematical formulas and theories that form the basis of cybernetics (Wiener's *Cybernetics* is described by Kline as “undecipherable by most readers” and “directed at Ph. D. mathematicians”) (12). Kline expertly simplifies for widespread understanding of such concepts throughout the book—either using analogies and metaphors of his own or incorporating relevant examples presented in historical documents. The book is fully referenced with endnotes and contains an index. At times, the accounts of conferences and research forums fill the pages with names, dates, titles, places, and people; readers may find themselves overwhelmed in getting the big picture of “who's who” in cybernetics. There are few references to the Soviet Union's approach to cybernetics, but Kline does acknowledge that Cold War-era secrecy and censorship led the Soviet interpretation of cybernetics in quite a different direction than the North American and western European one. Otherwise, critical and alternate viewpoints of the science are presented from noteworthy scholars, providing numerous perspectives on this intriguing and overlooked subject.

Taking stock of a pivotal era in history consisting of the birth, evolution, and eventual decline of an early modern interdisciplinary science, Kline details the research infrastructures and interpersonal relationships formed to enable cybernetics to take on such a profound niche in mid-twentieth-century science.

As impressive as the account of cybernetics' contributions to human society and technology may be, those perusing *The Cybernetics Moment* will benefit greatly from learning of the accomplishments of scientists who, despite being of considerably diverse backgrounds, came together under a united vision that helped usher in a new age and ideology. Perhaps there are lessons here today for those involved heavily in interdisciplinary work or research, an interesting subtext that runs throughout the work as one relives letters between colleagues and records of discussions at conferences around the globe. One seemingly cannot help but look to present-day emerging interdisciplinary fields and see how the logistics of research have (or have not) changed in comparison to the Cold War era. Alas, as is evidenced by its unpopular recognition today, cybernetics as a discipline eventually faded into near-obscurity, leaving behind only its profound influence in certain aforementioned fields.

"Cybernetics in Crisis," Kline's seventh chapter, explores the unfortunate decline and discrediting of cybernetics. Suffering from a fad-like craze amongst not only scientists but also the general population, cybernetics began to take on an "uncertain identity" (200). For example, consider the popularization of science fiction throughout the mid-twentieth century: obsession with artificial intelligence, cyborgs (more concepts originating from cybernetics), and belligerent technocracy paved the way for all-too-familiar embellished fantasies and horrific tales of utopian/dystopian futures, respectively (James Cameron's *Terminator*, anyone?). Mass media may have sensationalized cybernetics, but the academic discipline itself also suffered in reputation due to a "proliferation of meanings of cybernetics" (179). Too often, according to Kline, scholars mistreated Wiener and Shannon's core theories by misunderstanding basic concepts (due to the complex mathematical expressions at their core), resulting in questionable publications that swayed the discourse into areas often questioned by the more learned and experienced cyberneticians. The cybernetics movement ultimately suffered a striking blow in the early 1970s when funding was diverted to the more-focused fields of neuroscience, information theory, and control engineering—fields ultimately born out of cybernetics research but more practical than cybernetics as a discipline unto itself.

Today, only a few outposts of cybernetics still exist. Two distinct fields emerged out of the perilous phase of troubled meanings: First-Order Cybernetics (based at the Institute of Electrical and Electronics Engineers Society on Systems, Man, and Cybernetics), and Second-Order Cybernetics, overseen to this day by the descendants of Shannon and Wiener's science.

Our so-called present information age, per Kline, owes significant credit to cybernetics for the creation and popularization of its language and discourse in

the diasporas of academe, popular culture, and mass media. After reading this book, I find it hard to disagree. For the academic librarian, this text will provide freshly represented perspectives on the origins, theories, and reasoning behind the information age. However, do not expect much talk of librarians and libraries here—the book focuses on the originators and philosophers of the information age who consist mostly of engineers, communication scientists, anthropologists, computer scientists, biologists, doctors, and a host of other research professionals in similarly influential fields. Nonetheless, the knowledge offered in *The Cybernetics Moment* will greatly contribute to any reader seeking an enhanced or more comprehensive understanding of our present-day discourse surrounding information, while also providing a detailed and well-warranted history of the science of cybernetics.

REFERENCES

“The Thinking Machine.” 1949. *Time* 53.4:68.