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Essay review

Cybernetics and the machinery of rationality

Flo Conway and Jim Siegelman, *Dark Hero of the Information Age: In Search of Norbert Wiener, the Father of Cybernetics*. New York: Basic Books, 2005. Pp. xv + 423. ISBN 0-7382-368-8. $27.50 (hardback).
Hunter Crowther-Heyck, *Herbert A. Simon: The Bounds of Reason in Modern America*. Baltimore: Johns Hopkins University Press, 2005. Pp. xi + 420. ISBN 0-8018-8025-4. £33.50 (hardback).
Philip Mirowski, *Machine Dreams: Economics Becomes a Cyborg Science*. Cambridge: Cambridge University Press, 2002. Pp. xiv + 655. ISBN 0-521-77526-4. £28.00 (paperback).
Sharon Ghamari-Tabrizi, *The Worlds of Herman Kahn: The Intuitive Science of Thermonuclear War*. Cambridge, MA: Harvard University Press, 2005. Pp. 387. ISBN 0-674-1714-5. £17.95 (hardback).
S. M. Amadae, *Rationalizing Capitalist Democracy: The Cold War Origins of Rational Choice Liberalism*. Chicago and London: University of Chicago Press, 2003. Pp. xii + 401. ISBN 0-226-10654-4. £13.50, $19.00 (paperback).
Jean-Pierre Dupuy, *The Mechanization of the Mind: On the Origins of Cognitive Science*. Tr. M. B. DeBevoise. New French Thought. Princeton: Princeton University Press, 2000. Pp. xvi + 210. ISBN 0-691-02574-6. £24.95 (hardback).
Roberto Cordeschi, *The Discovery of the Artificial: Behavior, Mind, and Machines before and beyond Cybernetics*. Studies in Cognitive Systems, Vol. 28. Dordrecht, Boston and London: Kluwer Academic Publishers, 2002. Pp. xx + 312. ISBN 1-4020-0606-3. €104.95 (hardback).
David A. Mindell, *Between Human and Machine: Feedback, Control, and Computing before Cybernetics*. Baltimore: Johns Hopkins University Press, 2002. Pp. xiv + 437. ISBN 0-8018-8057-2. £18.00 (paperback).

William Whewell, brought forward a century or so, 'would not have dissented from the view that scientific behaviour can be classified as appropriately under cybernetics as under logic'. So observed Peter Medawar in the late 1960s, in an attempt to describe, and demystify, the self-correcting process at the heart of inductive reasoning.[1] As the very model of unifying scientific method, cybernetics could be counted on to run roughshod over the boundaries separating the special sciences, and so it proved. By emphasizing how

1 P. Medawar, *Induction and Intuition in Scientific Thought*, London, 1969, 54–5, quoted in the *Oxford Dictionary of Scientific Quotations* (ed. W. F. Bynum and R. Porter), Oxford, 2005, 430.

systems of whatever type were organized, cybernetics, and the new information sciences of the mid-twentieth century generally, encouraged research that ultimately linked neurology, the biological sciences, electrical and mechanical engineering, political science, psychiatry, operations research, game theory, economics, sociology, anthropology, mathematics, psychology and philosophy of science. Doing away with distinctions between the disciplines, cybernetics did away at the same time with other, more entrenched distinctions – between nature and artifice, things and ideas, values and rationality.

Serious consideration of the history of these developments invites narratives that challenge disciplinary histories and give attention to the problems of disciplines and their boundaries.[2] The books under consideration here take up this challenge by looking at how cybernetics and the related fields of the information sciences, systems analysis and rational-choice theory were sustained by anti-disciplinary forces. These turn out to include Cold War politics, interdisciplinary departments, discussion groups, think tanks and their public and private patrons. But what form of narrative suits these stories best? Despite the centrality of collaboration and community for these sciences, a number of the recent histories are biographies of cybernetic heroes: Norbert Wiener, Herbert Simon, John Von Neumann and others. A question to pose of these works, then, is how far the various concerns and disciplines that made up the cybernetic project can be examined and explained through the prism of any single life.

In the case of Flo Conway and Jim Siegelman's popular biography of Wiener, the answer is: not all that far. Born in 1894, Wiener completed college by the age of fifteen and graduate study by eighteen before going on to the mathematics department at MIT, where during the 1930s he worked on questions of Brownian motion, harmonic analysis and ergotic theory.[3] After the outbreak of the Second World War, Wiener turned his attention to problems of anti-aircraft fire control and how people, organisms and machines could achieve goal orientation (or 'teleology') via negative feedback.[4] This work, and his subsequent conversations with other academics from across the physical and social sciences, led to Wiener's coining the term 'cybernetics' (from the Greek for 'steersman') in 1948, in a book of the same title. For many, Wiener's work authorized the search for and description of teleology in nature – an approach that many of Wiener's readers held to have been (officially) banned by Galileo's supplanting of knowledge of the fourth and final cause as the goal of natural philosophy.[5] After the war, Wiener withdrew

2 For instances of disciplinary development of biology in the context of cybernetics and computer technology see L. E. Kay, 'Who wrote the book of life? Information and the transformation of molecular biology, 1945–55', *Science in Context* (1995), **8**, 609–34; E. F. Keller, 'Synthetic biology redux – computer simulation and artificial life', in *idem, Making Sense of Life: Explaining Biological Developments with Models, Metaphors, and Machines*, Cambridge and London, 2002, 265–94; D. Haraway, 'The high cost of information in post-World War II evolutionary biology: ergonomics, semiotics, and the sociobiology of communication systems', *Philosophical Forum* (1981–2), **13**, 244–78.

3 For details see P. R. Masani, *Norbert Wiener, 1894–1964*, Basel and Boston, 1990.

4 A. Rosenbluth, N. Wiener and J. Bigelow, 'Behavior, purpose and teleology', *Philosophy of Science* (1943), **10**, 18–24.

5 For examples of this perspective in psychology see O. K. Moore and D. J. Lewis, 'Purpose and learning theory', *Psychological Review* (1953), **60**, 149–56; G. A. Miller, E. Galanter and K. H. Pribram, *Plans and the Structure of Behavior*, New York, 1960.

from military work and repeatedly warned that the forms of automation he had envisioned could end up trampling humanistic values.

To be sure, Conway and Siegelman's biographical focus yields a number of dividends. They demonstrate Wiener's persistent but easily overlooked interest in how meaning and truth arise from context, from his graduate-school days on. They diagnose his well-known oddities as resulting from manic depression arising from the particularly harsh upbringing and home schooling he received from his father. And they judge that a well-known but previously unexplained split between Wiener and the neurophysiologist and cybernetician Warren McCulloch resulted from Wiener's wife Margaret suggesting – falsely – that their daughter had been seduced while under the supervision of McCulloch. If that is right, then Wiener's private life, so much at the centre here, is indeed crucial to understanding the professional development of cybernetics. Nevertheless, the book suffers, as biographies so often do, from a lack of proper context. As Conway and Siegelman depict him, Wiener often seems like a particle moving randomly under the Brownian motion he once investigated. What motivated him to connect statistics, communication, computers, human values and society? For all its probing, this biography leaves us little the wiser.

Much more successful is Hunter Crowther-Heyck's exemplary intellectual biography of the polymath Herbert Simon. Crowther-Heyck deftly contextualizes Simon's lifework simultaneously within both the institutions through which he travelled and the fields of inquiry to which he contributed: studies of bureaucracy and organizations, economics, computer science and information technology. For Simon as for many of his contemporaries, work with the computer allowed slippage between fields. It was a means for treating within a single frame everything from software to systems of various kinds (machines, organisms, organizations, minds) and even the process of acquiring knowledge. Indeed, as Crowther-Heyck explains it, Simon's work can be understood as an effort to unify the sciences which modelled human nature as the result of choice, notably economics, with the sciences of control through human nature, such as social psychology and sociology. Simon connected these by developing a new vision of human nature as well as innovative methods of investigation, namely mathematical and computer modelling. This vision rested on 'bounded rationality', the view that people on the one hand are capable of independent reason and on the other hand have limits on their capacity for acquiring, holding or processing information.

Simon's bounded-rationality notion reflected what Crowther-Heyck characterizes as his bureaucratic mindset. Unlike Wiener, Simon was a consummate institution-builder who skillfully managed patrons, university administration and colleagues. Simon's early work on organizations framed individual rationality not as hampered by its place within the hierarchy of an institution, but as made meaningful by that place. Later, in his work on computation, Simon would come to see hierarchies not only as the frame that made thought make sense, but as a model of thinking itself.

While on its surface Philip Mirowski's book delivers an examination of the trajectory of the discipline of economics under the influence of cybernetic ideas, it too is biographically oriented. *Machine Dreams* is essentially a survey of the three stages of John Von Neumann's intellectual life and a detailed examination of the ways in which the field

of economics often unwittingly shadowed the same trajectory as Von Neumann himself, from mathematical logic to games and strategy to automata studies. Mirowski puts this argument together though a fine-grained examination of economic ideas as they developed within such organizations as the RAND Corporation and the Cowles Commission. Challenging standard ideas of continuous progression or of continuity in neoclassical economics, Mirowski recasts the history of the last half century of economics as a series of incomplete accommodations to the intellectual innovation of cybernetics. He is particularly concerned to demonstrate that, far from having advanced through objective and value-free analysis, economics has been driven by the political concerns of the Cold War. Indeed, where economics has not followed Von Neumann's lead, Mirowski criticizes the field, bemoaning its periodic failures to understand or follow the full implications of the cybernetic world view. Even by the time of William Stanley Jevons's *Pure Thought* (1890), economic theory had experienced, in Mirowski's despairing view, 'deleterious divergences from the cyborg project nascent in the writings of [Charles] Babbage' (p. 41). Mirowski also suggests that the field has been concerned to deny such debts to Von Neumann as it managed to acquire.

Sharon Ghamari-Tabrizi examines the RAND Corporation in Cold War America and one of its more famous products, Herman Kahn's 1960 book *On Thermonuclear War* (*OTW*). Examining these in what she calls 'aesthetic' terms, she notes how *OTW*'s audience reacted to the book as a part of the genre of the grotesque that included *Mad* magazine and the 'sick' jokes popular in the 1950s. Ghamari-Tabrizi's aesthetic analysis also explains how RAND's analysts garnered as much epistemic authority as they did in this period. How was it, for instance, that nuclear strategy could be placed in the hands of people with little background in military affairs? RAND analysts differentiated themselves by cultivating and projecting avant-garde personae. Ghamari-Tabrizi compares Kahn, his colleagues and his audiences to the world of jazz music because both valued spontaneous and improvisational performance, whether the instrument was systems analysis or a saxophone. Kahn and his colleagues at RAND advertised their own work as simultaneously creative, complex, quantitative, intuitive, dispassionate, objective and insightful. While they advocated quantitative work, RAND analysts such as Kahn emphasized a mode of heuristic reasoning in which the form of analysis trumped both data and experience (p. 76). In making the case for their analyses over those of people in the military, RAND analysts advanced a form of thinking that reached 'dispassionate' and 'objective' yet data-free conclusions over what they characterized as the military's 'subjective' and 'qualitative' plans (p. 125). Ultimately, they did not let facts get in the way of scenarios that, in some world, could possibly be true – even if they never could be tested (pp. 177–80).

Sonja Amadae explains that the authority of RAND's mode of analysis depended not so much on its cultural form as its political affiliation. The institutionalization of the systems theory and rational-choice analysis in which RAND specialized did not depend on the fields' prior credibility. It was the reverse: RAND's credibility, and by extension that of its reasonings, hinged on having already won bureaucratic battles. The core of Amadae's *Rationalizing Capitalist Democracy* is an intellectual history that overlaps with this story of institution-building: the rise of rational-choice theory in economics,

political theory and policy analysis as a project for defending liberalism. Unlike other mathematizing social-scientific approaches then available, rational choice had been constructed from the ground up to place the individual at the centre of social analysis. Amadae maps out how rational-choice theorists fought off socialism, Keynesian and welfare economics and Marxism – and in the process reconceived politics, by simultaneously asserting the objective and universal nature of their science and, in the case of Kenneth Arrow, redefining rationality in such a way as to demonstrate the impossibility of achieving collectively rational decisions. The effect was to move political theory away from concern with the 'public' and refocus it on the aggregation of the preferences of individuals.

Together Mirowski, Ghamari-Tabrizi and Amadae highlight that the RAND Corporation's nominally value-free mode of analysis was, in fact, deeply political. Mirowski shows economists constrained by their individualistic bias. Ghamari-Tabrizi demonstrates that Kahn's work was largely structured so as to legitimate nuclear war as a rational and moral option (p. 215). When he concluded that it was possible to wage nuclear war with the Soviet Union to a 'satisfactory' outcome, he meant that although democracy might be curtailed in its aftermath, the United States would maintain its system of bourgeois values after the prospective war, despite the death and destruction wrought. And, as Amadae indicates, in the hands of public-choice and positive political theorists, 'rational' came to mean defence of the status quo.

So is all of this truly a Cold War phenomenon? Jean-Pierre Dupuy offers a contrary perspective. He sets his task as updating the account of the Macy Foundation meetings on cybernetics previously discussed by Steven Heims.[6] These were deliberately interdisciplinary affairs, bringing anthropologists, zoologists and others into the cybernetic fold. Less concerned with politics and more concerned with intellectual history than Heims, Dupuy presents cybernetics not as the scientific expression of the liberalism of the 1950s but as a natural outgrowth of the mathematical logic of Alan Turing and Kurt Gödel in the 1930s. His focus on ideas as isolated from personal and social factors leads to an account of cybernetics so purified that some of the cyberneticians turn out not to have understood cybernetics. One might want to see this as an analytic distinction doing violence to actors' categories, but Dupuy is an actor himself (pp. 25–6). He argues that cybernetics set the stage for contemporary cognitive science, which has gone astray by not following the cybernetic programme, and builds a strong case for a disjunction between the mind as understood in cybernetics and that in cognitive science (the first sees meaning everywhere, the second locates it only in symbols).

David Mindell and Roberto Cordeschi likewise see cybernetics as arising from events that preceded the Cold War. But where Dupuy takes those events to be developments in logic, Cordeschi concentrates on efforts to build mechanical representations of human behaviour, and Mindell on work in mechanical and electrical engineering. Cordeschi examines how early twentieth-century devices drew from and contributed to research on familiar questions about organic mechanism in the work of such figures as Jacques Loeb, demonstrating how intertwined were actual machines with the questions about the

6 See S. J. Heims, *The Cybernetics Group*, Cambridge, MA, 1991.

plasticity of behaviour, memory and learning raised by physiologists, neurologists and psychologists. His innovative history provides the tools for a new and useful explanation of the variety of ways the fields of cybernetics, robotics, cognitive science and artificial life have made and interpreted models.

Mindell centres his analysis on a set of engineering cultures after the Second World War in defence contracting firms such as Sperry Gyroscope, as well as at Bell Labs and at MIT. In these locations engineers and scientists sought to solve problems of signal amplification, feedback and servo-control. Each institution developed its own techniques for treating diverse issues such as fire control or cross-continent telephony. It was, ultimately, the war, and Warren Weaver's style of management, aiming to produce innovation though interdisciplinary innovation, that integrated these various approaches. Wiener got more credit for it than he deserved largely because, unlike those whose work remained classified, he dropped his security clearance after the war, leaving him free to publish *Cybernetics* in 1948 and receive plaudits for synthesizing the sciences of information and control.

Although the books reviewed here have quite different perspectives, one uniting thread is the extent to which the cybernetic and system sciences, as was typical of Cold War thought, universalized that which was local and particular. With only a little looking we can find Cold War politics just where scientists claimed it was absent. We can find it in cybernetic scientists' persistent strategy of speaking about themselves, their models and people in general in the same breath. Even as mid-century social scientists strove to distinguish their form of expertise as objective, apolitical and value-free, they simultaneously conducted their work on the descriptive register of *is* and normative register of *ought*. These discussions functioned in such a way that methodological imperatives for how the scientists should operate were interchangeable – recall the Medawar quotation with which I began – with descriptive accounts of how humans and machines do function. As Mirowski and Amadae show us, econometricians, rational-choice theorists and game theorists saw humans as, respectively, econometricians, rational-choice theorists and game theorists. Crowther-Heyck demonstrates that Herbert Simon's model of man was, fundamentally, Simon himself. Dupuy notes that this mixing of *is* and *ought* remains a persistent feature of the cognitive sciences (p. 13). As a group, the books reviewed here indicate how such efforts to eliminate politics and subjectivity actually installed these things at the foundation of the cybernetic sciences – the description of rationality itself.

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