

AMERICAN POLITICAL SCIENCE REVIEW

MARCH 1977

The Sciences of the Artificial. By H. A. Simon.
(Cambridge, Massachusetts: The MIT Press,
1969. Pp. xii, 123. \$2.45.)

Systems theory arose in the Department of Defense as a fancy expression of that immemorial fiscal creed—buy cheap and sell dear. Now writers with an ineradicable ache for the most various of technical pursuits are regularly described as systems theorists; what unites them, aside from a plangent concern for the interconnectedness of things, is an inclination to reject as intolerably partial and dissection the methods and models of classical physics and a barely barbered enthusiasm for such ripely comic subjects as cybernetics or the theory of artificial intelligence.

In *The Sciences of the Artificial*, for example, H. A. Simon describes the “design of an intellectual structure aimed at accommodating those empirical phenomena that are ‘artificial’ rather than ‘natural,’ ” (publisher’s blurb); such efforts, at any rate, dominate three of the book’s four chapters. The last essay, “The Architecture of Complexity,” was not delivered as part of the Karl Taylor Compton Lectures at MIT and appears in this book as an editorial afterthought. (Published in 1962 as part of the *Proceedings of the American Philosophical Society* [106, 467–482], it offers rather a gelatinous discussion of such topics as the theory of complex and hierarchical systems and the Simon-Ando theorem on dynamical systems; readers looking for a trustworthy trot to the technical material would do better to consider Fisher and Ando’s “Two Theorems on *Ceteris Paribus* in the Analysis of Dynamical Systems,” *The American Political Science Review* [56, 108–113, 1962].) By systems that are artificial Simon means systems that are *goal directed* or *purposeful*. These are objects of considerable internal complexity, but, Simon argues, “the possibility of building a mathematical theory of [such systems] or simulating [them] does not depend on having an adequate micro-theory of the natural laws that govern the system’s components” (p. 19).

Instead, the theoretician need attend chiefly to the *environment* in which the system is situated: the system’s theory will hinge on only the most modest of physical assumptions about the system’s structure.

There is no arguing with this in the abstract, of course, but the specialization of the thesis to human beings—the theme of chapter two—is quite unconvincing. There Simon asserts that “a man, viewed as a behaving system, is quite simple. The apparent complexity of his behavior over time is largely a reflection of the complexity of the environment in which he

finds himself” (p. 25). This is a position that he reaches by meditating on insects. The course of his argument involves the following steps. To consider an ant simply as a “behaving system” is to consider it purged of internal structure—that is the province of biochemistry. Simulating its gross behavior, as it scurries along the surface of the earth, involves only the application of a few principles dealing with the calculation of local optima and the like. What holds for the ant holds for men, Simon believes, at least if the analogy is carried to human beings considered simply as cognitive devices. Nor is the point limited to human beings: *all* systems that think are quite simple; elementary information processing principles explain their behavior (as well as the behavior of such concocted items as the digital computer). This is not behaviorism, of course, since Simon recognizes that human beings process information by means of principles that are internally represented and in any case innate, but it is a view comfortably within the empiricist tradition, and Simon’s chief claims would, I dare say, be accepted as a natural point of convergence by other researchers working on artificial intelligence and theories of information processing.

What of the evidence for these conclusions? For the most part, Simon draws on fairly well-known (and none-too-recent) work in the analysis of short term memory; there is some evidence too from work in the simulation of crypto-arithmetic abilities and the capacities involved in the memorization of nonsense syllables and the organization of visual memory. A taste for the friendship of his natural enemies also leads Simon to the utterly improbable conviction that his views are sustained by the work of transformational grammarians. Although “the picture will continue to be enlarged and clarified,” he avows, “we should not expect it to become essentially more complex” (p. 53).

The skeptic, however, will observe that this quotation reflects a degree of intellectual optimism made possible only by its author’s unquenchable enthusiasm for the inflation of trivialities. An achievement such as the creation of an information processing model (the so-called EPAM program) by which the memorization of nonsense syllables may be mimicked hardly suggests a perfect understanding of human intellectual capacities that are either characteristic or deep. The insights that Simon records about the organization of short term memory, while genuine, need to be set against the relatively bleak panorama provided by our ignorance of the principles that govern long term human memory. In this regard, one might