Order to Chaos Versus Chaos to Order

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The Origins of Order. By S. A. Kauffman. New York: Oxford University Press, 1993. xviii + 709 pp. $75.00 (hard), $29.95 (soft).

Complexity: Life at the Edge of Chaos. By R. Levin. New York: Macmillan, 1992. x + 208 pp. $10.00 (soft).

Complexity: The Emerging Science at the Edge of Order and Chaos. By M. M. Waldrop. New York: Simon & Schuster, 1992. 380 pp. $22.50 (hard), $12.00 (soft).

With the publication of James Gleick's (1987) book *Chaos: Making a New Science,* the science of nonlinear systems moved from the esoteric pages of obscure journals to the latest fad in the popular press. Notions of "chaos theory" were invoked, more often than not in a pseudo-scientific and cavalier fashion, to "explain" the turmoil in social and cultural systems. After all, Gleick had demonstrated that even simple systems with two variables interacting in a nonlinear relationship could result in unpredictable and seemingly chaotic behavior. It appeared, based on Gleick's arguments, that the social scientific enterprise should abandon, once and for all, any delusions about making long-range predictions about social phenomena that were characterized by nonlinearities. Gleick had succeeded in impressing upon the public the transition in nonlinear systems from order to chaos. It was left to three more recent offerings, reviewed here, to highlight the transition in nonlinear systems from chaos to order.

In the span of half a decade since Gleick's book, the term *chaos* has been replaced by a new buzzword, *complexity*—a term that appears in the title of two of the books under review. Both Lewin and Waldrop offer nontechnical narratives of the research activity at the Santa Fe Institute, described as the "crucible of the new science of complexity" (Lewin, 1992, p. ix). The third book, by Stuart Kauffman, a resident scholar at the Santa Fe Institute, offers a more technical assessment of the current status of this emerging field. All three books seek to make the same general argument: the science of complex nonlinear systems will help us "under-

stand the spontaneous, self-organizing dynamics of the world in a way that no one ever has before—with the potential for immense impact on the conduct of economics, business, and even politics." (Waldrop, p. 13) They acknowledge Gleick's observations that nonlinear systems can degenerate from an ordered to a chaotic state. But their focus is on systems that start out in a state of disorganization and through a series of nonlinear interactions spontaneously self-organize into an ordered structure. The three books offer examples of several researchers who are attempting to model this self-organizing process in a variety of contexts, such as anthropology (the progression from a foraging band, to tribe, to chiefdom, to state), evolutionary economics (market behavior in nonequilibrium conditions), molecular biology (the self-organization of protein cells), and ants (the organization of ant colonies).

The three books differ in their tenor. Waldrop comes closest to Gleick in offering a lucid, albeit noncritical, fan-like documentary of the activities at the Santa Fe Institute. Kauffman provides a more comprehensive, though relatively less comprehensible, description of the nonlinear mechanisms ("random grammars") that lead to the emergence of self-organized patterns. Lewin alone tempers the enthusiasm for this movement by discussing some of the skepticism, criticism, and in some cases, disdain leveled against the Santa Fe research program. For instance, there are those who consider what the Institute does as mathematically interesting but substantively trivial. There are others who, while granting that the Santa Fe researchers have demonstrated the occurrence of self-organization, are still seeking an explanation for how the order emerges. Finally, there are those who see the current fascination with self-organization as a phenomenon that is as mystical, nongeneralizable, and faddish as Catastrophe Theory was in the late 1960s.

Reference

Gleick, J. (1987). *Chaos: Making a new science.* New York: Viking.