the rise and fall of creativity in the life course of artists and scientists and the prediction of their times of death ("Did Einstein publish too much?"), the cumulative number of American Nobel Prize winners, the substitution of cars for horses in personal transportation, the cumulative number of films produced by Alfred Hitchcock. Studiously obeying the "law of the hammer," Modis seemingly cannot resist putting any set of historical time-series data on his personal computer workbench and pounding away. In the process, he subjects virtually every technological growth curve from the first (canals and tunnels), second (railways, steamships, cars, subways, and oil pipelines), and third (paved roads, motorized ships, natural gas pipelines, car populations, jet engine performance, passenger aircraft performance, passenger air traffic, and personal computer manufacturers and models) waves of industrial growth to analysis, puts forth some intriguing forecasts for energy, environmental waste-management, and transportation technologies in the forthcoming decades, and even gives a chaos-theoretic interpretation to the erratic fluctuations often observed after a growth or diffusion process has closed in on its ceiling. I strongly recommend the book to readers who may be interested in such analyses and conjectures.

On the other hand, I am compelled to note that Modis misses many opportunities to relate his work to a large and growing body of social-scientific literature on the same or similar topics. Modis is the latest of a long line of physicists to poach on social science territory in relative ignorance of extant relevant theories, methods, concepts, and findings. As he remarks (p. 22), "Squeezed by diminishing returns, physicists have started to scatter outside the musty dungeons of particle accelerators in recent years." My point is not the pedantic one that Modis should have cited more extant social science literature. Rather, it is that much of his work could have been made stronger and more general, and precisely what his unique contributions are made more apparent, by being brought into contact with this literature. Some examples: Modis seems blissfully unaware of the decades-long tradition of modeling the diffusion of innovations, technologies, information, and cultures by S-curves (with contributions by, among others, S. Dodd, W. F. Ogburn, J. S. Coleman, and R. L. Hamblin); he similarly seems not to be aware of much of the work by futurologists (such as R. U. Ayres) on the use of S-curves and envelope-curve analysis for predictions; extant applications of evolution through natural selection and Volterra-Lotka systems to the interactions of human populations (for example, by N. Keyfitz), organizations (for example, by M. Hannan and J. Freeman), and consumer goods (for example, by V. Mahajan and R. A. Peterson) similarly seem to have escaped his attention; and his advice to management that there is a time to be conservative (when the S-curve is in steep growth) and a time to innovate and explore new directions (when the growth curve starts flattening out) is not related to various theories of organizational behavior and management (such as the hierarchical garbage-can theory of J. Padgett) from which similar normative guidelines previously have been deduced.

It should be noted that Modis is not completely remiss with respect to previous social science research. For instance, he does cite the relationship of his "overall" 56-year cycles and evidence on the associated clustering of technological innovations to prior work by Kondratieff and Schumpeter (in my opinion, Modis's evidence on these topics is more extensive and compelling than that of either of these scholars). It also must be acknowledged that there are finite limits to the capacity of any scientist to engage the theories, concepts, and findings of many disciplines. Nonetheless, to avoid perpetual reinvention of the wheel, multidisciplinary collaboration and cooperation with respect to modeling complex social and natural systems and forecasting or foretelling the future (which this reviewer previously has attempted to foster) appear to be called for.

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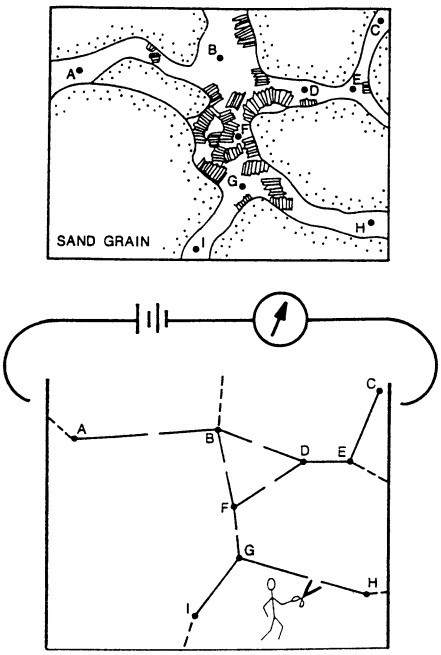
Geofractology

Fractal Models in the Earth Sciences. G. KORVIN. Elsevier, New York, 1992. xxviii, 396 pp., illus. $125.50.

More than any other single book, Mandelbrot's *The Fractal Geometry of Nature*, first published in 1977, introduced the scientific community to the concepts of self-similarity and its ubiquitous occurrence in nature. Since many of the examples in that book were drawn from the earth sciences (the length of coastlines, the morphology of rivers, lakes, and islands, and the shapes of clouds), it has inspired scientists from a wide range of earth science disciplines to look for self-similarity in their data. In some instances they have gone on to ask deeper questions regarding the physics that is responsible for the observed fractal geometry or observable physical consequences of the fractal structure.

In *Fractal Models in the Earth Sciences*, Korvin reviews the progress of fractal research in the earth sciences since Mandelbrot's original book. Korvin states in the preface that this book is not intended as a textbook in fractals, and I must agree that it is not a good first book for someone not familiar with fractal analysis. Rather, it is a loosely organized collection of case studies, interspersed with bits of mathematical background and sprinkled with literary references and artistic plates presumably intended to give it a certain intellectual patina. To his credit, the author does touch on most of the important applications of fractal analysis that have been developed in the earth sciences, and the book is a valuable source of references otherwise widely scattered across the scientific literature. On the negative side, the coverage is so broad that it is sketchy in many areas. Not surprisingly, the strongest coverage is in the author's field—the fractal geometry of pore space in sedimentary rock and its implications for permeability. The discussion of fractal research in geomorphology as applied to coastlines, lakes, and islands is also strong, as is an interesting and unique discussion of the implications of fractal geometry for exploration geophysics. The weakest discussion is that of fragmentation and earthquake statistics, which does not include recent ideas on the role of self-organized criticality and dynamical systems in establishing temporal and spatial self-similarity in these systems.

What I found most disappointing about this book is that the discussion does not go very far beyond the individual studies.



"Fluid transfer through a kaolinite-bearing sandstone [top] and the corresponding percolation model [bottom]. The symbolic 'current' can be an arbitrary transfer process." [From *Fractal Models in the Earth Sciences*]

Although an effort is made to put the recent work in a historical context and to provide some of the mathematical background, there is little attempt to put the work in any sort of philosophical context. For example, no clear distinction is drawn between measurement techniques developed to establish fractal geometry, measure the fractal dimension, and establish the limits of fractal behavior, models that attempt to explain why a system is fractal, what determines the fractal dimension, and what sets the fractal limits, and models for the physical behavior of a fractal system such as scattering from a fractal surface or the permeability of a fractal network of pores or cracks. Rather, the treatment has more a tone of gee whiz, look at all the interesting examples of self-similarity in nature, and some of the clever mathematics behind it.

In summary, Korvin's book is a useful introduction to fractal research in the earth sciences for scientists who are already somewhat familiar with fractal analysis. The discussion is particularly strong with regard to geomorphology, sedimentology, and exploration geophysics, less so with regard to fragmentation, faulting, and seismicity.

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