Why Things Develop:
On the Self-Organization of Recursive “Probes” in Possibility Space

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Development and dissolution are basic characteristics of a wide variety of systems. Among the latter are biological ones, but also non-living systems like, for example, geological ones, and of course also social systems. As has been known for a long time, decay processes in the physical and biological domains are determined by the entropy law. However, processes of the emergence of new structures, or of organizational forms, have become a topic of broad scientific investigation only during the last third of the twentieth century.

Based on the studies of the phenomenon of self-organization (or emergence), new approaches have emerged in recent years to understand the abstract machines behind structure generating and structure changing processes. This has lead to the design of nonlinear models for general systems, which, among others, are also applicable to historical processes. (See, for example, M. de Landa, “A Thousand Years of Nonlinear History”.)

Some of the contemporary instruments for the simulation of correspondingly complex systems on the computer are briefly reviewed, like, e.g., genetic algorithms and cellular automata. It is shown that the emergence of an “arrow of time” in biological, and even in social systems, can be explained on a firm basis. In doing so, decisive roles are attributed to a) the presence of recursive processes (like replications, for example) and b) significant fluctuations around mean values. Such systems can often be characterized by the self-organization of recursive “probes” in the space of potential forms of their organization. In sufficiently complex systems, the latter may emerge by their intrinsic dynamics (as in systems shown here to be characterized by “hierarchically emergent fractal evolution”), i.e., independent of any external control mechanisms.