1.1A Understanding Simple Statistical Stability

In the course of the discussion of varieties of simple behavior—fixed point equilibrium, limit cycles, and so on—the question arises how to classify a simple statistical stability, such as a constant annual suicide rate. The answer to the question raises the issue of statics *as contrasted with* dynamics.

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How should one classify a behavior such as a stability in suicide rates? It is a kind of degenerate fixed point behavior. The appropriate "dynamic" law is of the form: $S = c$; that is, the suicide rate S is a constant. I say that the equilibrium is degenerate because the mathematics of the law allows no possibility of change. It is perhaps more properly described as a static law. A more interesting law would set the suicide rate equal to some function of certain parameters of the system, such as the degree of social cohesiveness. (Durkheim was, in effect, looking for an equation of this sort.) But the behavior described by the more interesting law is also not truly dynamic, because it does not prescribe any way for a system to move from state to state as the relevant parameters change; indeed, it does not even imply that such movement is possible.

It is important to note, however, that the terms *static* and *degenerate* apply to only that aspect of a system's behavior described by the equation. The system may also be described by other, more properly dynamic laws (and of course, all systems are described by at least one dynamic law, at the level of fundamental physics). Consider as an example the behavior of a gas in a box at thermodynamic equilibrium. The ideal gas law, relating a gas's pressure, temperature, and volume ($PV = cT$), says something about a gas's behavior at any fixed point, but, like a Durkheimian suicide law, it says nothing about movement between fixed points. Yet there is, of course, a genuine fixed point equilibrium behavior of such gases, described by the second law of thermodynamics, which says that a gas, when disturbed, always returns to a fixed point at which pressure, temperature, and volume satisfy the ideal gas law. When these two laws are combined, one obtains the law that a fixed increase in pressure brings about a proportional change in temperature, and so on. Static laws such as the gas law are often treated as equivalent to the corresponding dynamic laws.

In general, whenever a degenerate fixed point law, such as $S = c$, is true of a system, there must be some genuinely dynamic law that is also true of the system, and which is responsible for the constancy in the system that makes the degenerate law true. The dynamic law does not have to be a fixed point equilibrium law, but it must underwrite some sort of stability. For example, it might entail that change happens very slowly, so that over a given interval of interest, the system's state is approximately constant.

Because static laws are true only in virtue of a system's dynamics, any inquiry into the physical basis of static laws must be, in part, an inquiry into dynamics. For this reason, I make no distinction in *Bigger than Chaos* between the problem of explaining static laws and the problem of explaining dynamic laws.