

Faia, Michael A. 2002. Differential Equation Modeling as a Source of Theoretical Insight: Four Disparate Examples. *Quality & Quantity*. 36: 169–195.

See <https://www.proquest.com/docview/786640076> . Accessed 27 March 2023.

Abstract: We explore differential equations involving alcoholism, social mobility, excess female mortality, and international arms competition. In each of these instances we show that the initial equation, or system of equations, has a sociological plausibility comparable to that of the associated solutions; the solutions do indeed describe time-series trajectories that seem to represent important and unique social processes. We argue that the central challenge of differential equation modeling is to use experimentation to clarify *relationships* between, on the one hand, the equations and their coefficients and, on the other, the solutions and the time-series orbits created by them. Such feedback interaction of differential equations and their solutions appears to be the basis for further theoretical insight, and rapid assessments of these interactions are now possible largely because modern software encourages experimentation with many combinations of input coefficients.

This paper expands on an argument made by Nielsen and Rosenfeld (1981, p. 161), who recommend that differential equations be interpreted in a way that emphasizes their solutions, i.e., the time-series trajectories of Y values, the orbits of Y , taken to represent behavior of dependent variables through time. We conclude that the most edifying interpretations of differential equations focus on the equations themselves, the resulting trajectories, the relationships between equations and trajectories, and the theoretical significance of all three.

Key words: hitting bottom, alcoholism, accumulative advantage, arms races, differential equation. Model, Peter Principle, female mortality, functional analysis, functionalism, Maple CAS occupational mobility, population pressure, Richardson theory of war, social mobility, sociological theory, sociology