

The Shape of Things to Come: When Developmental Curves Speak Clearly about the Nonlinear Dynamic Developmental Processes that Generate Them

Abstract of talk
conference on Modeling Developmental Processes in Ecological Context
in Tempe, Arizona – March 2004

Joseph L. Rodgers
University of Oklahoma

Many developmental processes can be considered as the diffusion of one or more behaviors through a social network. Cigarette smoking is an example. It would be hard to argue that there is a biological drive, or a natural social tendency, for an adolescent to put a lighted “tobacco-stick” into their mouth and inhale deeply; the onset of smoking seems obviously to derive at least partly from social influence. But there are different social explanations for how the onset of cigarette smoking may occur. One model implies that social observation and general participation in a “smoking culture” will lead to onset of smoking among adolescents. Another model implies that one-to-one social influence – direct social contagion – is at the basis of the spread of cigarette smoking in adolescents.

Diffusion processes can be broken into these two categories, general (or natural) diffusion and contagious (or prevalence-driven) diffusion. Burt (1987) noted that these two different types of diffusion (which he referred to as “structural equivalence” and “cohesion,” respectively) each generate prevalence curves with distinctive features. In the first case, general diffusion curves typically have a negatively accelerated exponential shape, whereas contagious diffusion leads to prevalence curves with an S-shape. In this paper, we further investigate the mathematics – both algebraic and geometric – of these two different types of processes. In particular, more complex dynamical developmental models may cross-over the boundaries between these two shapes, and specification of the situations at these boundaries can help us understand the social and psychological processes that generate such curves. We illustrate the empirical import of these developments using newly-collected data from 306 college students on the age of onset for smoking cigarettes and drinking alcohol. The inferences drawn from the mathematical theory are compared to actual reports from these students about the social and psychological influences that they report to be associated with their first smoking and drinking experiences.

Burt, R. S. (1987). Social contagion and innovation: Cohesion versus structural equivalence. *American Journal of Sociology*, 92, 1287-1335.