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The Inexorable Exponential

Many people view growth as akin to progress, achievement, and the good things of life. In contrast, a steady-state situation is viewed darkly. A 5-percent annual increase in the gross national product is considered healthy, while failure of the economy to attain an increase would be considered a cause for great alarm. The most valued form of growth is a steady increase each year. This can be expressed by the equation $x = x_0e^{kt}$, where x is the variable, x_0 is its value at time $t = 0$, and k is the growth rate. When $kt = 0.693$, $x = 2x_0$. Thus a growth rate of about 3 percent a year leads to a doubling time of 23 years. Such a rate seems sedate enough, but, as time passes, further doublings occur, so that ultimately the value of x goes to infinity. In any practical situation this is impossible, and, as Platt has pointed out, continuous growth often leads to great problems for society.

In the early part of this century our population growth was a source of great pride, while the more nearly static populations of some European countries were considered indications of decadence. Lately our attitude about population has been changing.

Despite our new realization that some kinds of growth are not good, this lesson will not be applied generally for a long time because of our inherent prejudice in favor of growth. Today the public is becoming concerned about the way nature is being despoiled. However, few seem to realize that most ecological problems can be traced to some aspect of exponential growth. In attempting to prevent further deterioration of the environment, ecologists and conservationists may find that their strategy of piecemeal attack on specific situations wins battles but loses the war. The toughest enemy is the inexorable exponent.

An example of the kind of problem ecologists face comes from the electric power industry. To satisfy public demands, the industry has increased its installed capacity at the rate of 6 to 7 percent per year for many years. Typical projections assume a similar rate of increase far into the future. All of us are indebted to this industry and the conveniences that it brings us. Take away dependable electric power and there remains a shambles. Yet the projected expansion will create great tensions. Already there are siting problems and complaints of thermal pollution. Air pollution and dangers connected with the nuclear industry will increase. At some point society must conclude that an exponential expansion in power output is not desirable.

Scientists are in the midst of traumatic sequelae to an unsustainable exponential growth in the support of research. Over a period of about two decades, beginning in 1940, federal expenditures for research and development rose by about 25 percent per year. When such growth was sustained for some years, the beneficiaries expected it to continue indefinitely. They were inclined to accept exponential growth as a law of politics or nature. Even as recently as a few years ago it was widely held that federal support for science should increase at the rate of 15 percent a year. This was at a time when the G.N.P. was growing at the rate of about 5 percent. Scientists might hope for, and argue for, a rate of growth somewhat larger than the G.N.P., but the larger the disparity, the quicker the disappointment.

Society has been, and still is, on a great growth kick. If we are interested in a long-term future for man, we will regard rapid growth with suspicion. We will look for, and point out, the unexpected and unpleasant consequences of exuberance long-continued, and seek to moderate it before irreparable damage has been done.—PHILIP H. ABELSON