Silly, yet important book

Robert McGinnis
1973*

In the final analysis, futurists rely on fear and fantasy, the consequence
of their dislike for the past and present.

<div align="right">Jeffrey St. John, 1972</div>

Who knows what evil lurks in the hearts of men?

<div align="right">The Shadow, 1942</div>

Many important books have been reviewed on the pages of journals
as have some that were downright silly. This is one of those rare works that
belongs in both categories. It is important for several reasons, primarily
because of the claims that the authors make, but also due to the prestigious
legitimation it receives from the sponsoring Club of Rome, and because of
its likely impact on both public thought and social science. It is silly because
of the way in which the authors arrive at their conclusions and the manner
in which they present them.

As the authors say, "It is not the purpose of this book to give a com-
plete, scientific description of all the data and mathematical equations"
(p. 23). But these, of course, are precisely what one needs in order to accom-
plish a careful evaluation of the model upon which their grim conclusions
rest. They assure us, however, that these details are provided in "the final
technical report of our project" (p. 23). Alas, in a footnote on page 125, it is
suggested that this report remains to be published, if not yet to be written.

What we have in place of a detailed description of the model is a slim
readable volume with many illustrations that is pitched at the level of the
reasonably bright high school senior. In all probability the book will prove
to be quite appealing to that audience. Its message is as shrilly clear as that
of an air-raid siren. At the same time it is obviously scholarly: each chapter
begins with an epigraph, such as those at the beginning of this review, at-
tributed to U Thant, Hau Fei-Tzu, St. Luke, Aristotle and others. (My person-
al favorite is the one at the beginning of Chapter III attributed to Heracli-
tus: "In the circumference of a circle the beginning and end are common."
Heady stuff indeed.) Many of the illustrations are photographic reduc-
tions of computer printout, reminiscent of Michael Crichton's best seller,

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Andromeda Strain. Nor do the similarities end with the illustrations.

What the authors are concerned with is nothing less than the planet earth, doomed to destruction not by a mysterious virus from outer space, but by avaricious over-populating humans. The purpose of the project was "to examine the complex of problems troubling men of all nations: poverty in the midst of plenty; degradation of the environment; . . . alienation of youth; rejection of traditional values; . . . [all] parts of the 'world problematique as the Club of Rome calls it . . ." (p. 10). To accomplish this task, more Herculean than the combined efforts of all social scientists throughout history, the authors examined five variables longitudinally: population size, agricultural production, amount of non-renewable natural resources available, industrial production and pollution. Values for these variables together with a number of others and their interaction effects ("feedback loops") were "estimated" *always at a world level of aggregation,* fitted as functions of time and projected through the year 2100.

We are informed that there are a "hundred or so causal links that make up the world model" (p. 121). But these links are depicted only in a mind-bending flow chart (figure 26), which looks not unlike a diagram of one of the secret plays that President Nixon sent in to the Washington Redskins, with a few Nike missiles scattered about the playing field. Each of the dotted lines represents a function with parameters estimated from time series data over periods somewhere within the 1900-1970 range. Whatever the nature of these innumerable functions and the values of their parameters, it becomes clear that the variables are ordered in a sort of stepwise fashion. Time is the ultimate driving variable. World population size and per capita industrial output are fitted as functions of time, and everything else is linked to these two variables. The crux of the exercise then is to fiddle with the functions that relate population and industrial production to time and to see what happens.

In most respects this is a sensible strategy, representing the standard approach to projection. However, the authors insist at a number of points that projection is *not* their purpose. Instead, they say that they are "interested only in the broad behavior modes of the population-capital system" (p. 91). But then it turns out that a behavior mode is just a function of time, which would appear to put them back into the projection business. Elsewhere, in reference to the computer-based graphs, the reader is told that "we have deliberately omitted the vertical scales and we have made the horizontal time scale somewhat vague because we want to emphasize the general behavior modes of these computer outputs, not the numerical values, which are only approximately known" (p. 123-124). Despite these assertions, the model contains assumptions about world "carrying capacities," i.e., limits to growth, that *are* numerical and critical to the model. The "behavior modes" of the variables are important only in relation to these

assumed limiting values. Moreover, the conclusions are numerical, albeit expressed vaguely. This *is* then a projection model and deserves to be evaluated as such. Before proceeding to this evaluation we should dwell a bit on the conclusions which the authors draw from their exercise.

The major conclusions are easy enough to spot. Most of them are set in pontifical italics. Thus, we are told that, under present and projected consumption rates, *"the great majority of the currently important nonrenewable resources will be extremely costly 100 years from now"* (p. 66, italics in original). Moreover, unless we change our collective ways, *"population and industrial growth will certainly stop within the next century at the latest"* (p. 126, italics in original). But the worst is yet to come: *"The basic behavior mode of the world system is exponential growth of population and capital, followed by collapse"* (p. 142, italics in original). By collapse they mean a catastrophic decline in food, population, industrial capacity and nonrenewable resources. This apocalyptic vision shall have been preceded by intolerable increases in levels of pollution.

In all of this gloom the authors provide a ray of hope, in fact a veritable escape hatch into a rosy world of stability. Their formula for global salvation consists of three simple requirements: "1. *The capital plant and the population are constant in size . . .* 2. *All input and output rates—births, deaths, investment, and depreciation—are kept to a minimum.* 3. *The levels of capital and population and the ratio of the two are set in accordance with the values of the society"* (p. 173-174, italics in original). There are a couple of hookers in this. Note first the phrase "the society/' singular. Evidently they are quite serious about their conception of a homogeneous world society, or at least this is the way that they have built it into the model. But not only do they fail to tell us how to achieve this hidden fourth requirement, they have no thoughts about how to accomplish the first three.

Despite these sometimes harsh words, I reiterate my earlier contention that this is an important book. The topic is certainly important, one might even say of global scope. The approach, while far from a model of social science modelling, does at least illustrate the potential for computer applications in the investigation of complex social systems. It is also important because their conclusions, when reexpressed with greater sobriety and caution, become inescapable. Evidently the book is being widely read and, thus, may be a valuable influence in bringing these profound issues to a wider audience. However, because of its shrillness and, in some important respects, simple-mindedness, it may simply foster that faddish hysteria which passes as concern for The Ecology. This would represent yet another detrimental aspect of the book, since such hysterical advocacy surely tends to discredit the efforts of serious, concerned scholars. At least some evidence for this side effect is at hand. The epigraph at the beginning of this review is from a column that appeared on the New York Times Opinion/Editorial page of December 5, 1972. In it, St. John used "Meadows and his team

of 'doomsday futurists' " as a springboard with which to pounce on any who doubt that "the heroic potential of the human mind" will save our skins. He denounces research that is relevant to social policy in that the latter implies planning, social control and stability.

I believe that a parallel detrimental effect may occur within social science itself. The several works, including The Limits to Growth, produced by the MIT group under the leadership of Jay W. Forrester have received such a roasting in the scientific literature that the entire cause of quantitative investigations of social systems could receive a serious setback. If this speculation proves to be wrong, as well it might be, then yet another specter haunts me. This is the prospect that research funding agencies will accept the favorable comments (cf. the blurbs on the back cover of the book, none of which is by a social scientist) and take The Limits to Growth as a model of how macroscopic social research ought to be done, namely, by systems engineers rather than by social scientists. The mind boggles, or at any rate mine does, at the prospect of, say, World Computronic's Chief Engineer assigning a dozen or so of his operations research/systems engineer people to redesign megalopolis and the political form necessary to make it work and then of presenting their game plan to the current Administration. In this vein, I find it somehow fitting that the Limits to Growth project was sponsored by the Volkswagen Foundation.

The book is silly and objectionable for some of the same reasons that I have called it important, but there are others in addition, of which three loom largest. These are admissible criticisms only if one agrees with my earlier contention that the world model is really just a projection system. Thus, Meadows et al. are in a position to dismiss these observations while I am not.

The model connects capital and population to time and hinges everything else on the "behavior modes" of these two variables, so that the entire outcome depends on the two functions of time. In this case, as in that of a second-rate spy thriller, the outcome was telegraphed in the opening chapter, entitled The Nature of Exponential Growth. Now any fool knows that what goes in exponential comes out exponential. Furthermore, any fool who has had an elementary course in the algebra of real functions knows that an exponential function either grows without limit or decays to zero, depending on the sign of the rate coefficient. Since, so far as one can determine, the authors set the two time functions as exponential, resources as inverse to and pollution as linear in capital formation, then the whole end product is *necessarily* catastrophic. Nathan Keyfitz put it well in observing that such an exercise as this "may be useful in simply telling us that existing rates cannot continue," (Keyfitz, 1968, p. 87), but that in conducting it one is not necessarily predicting.

The second reason why I consider this to be a rather silly work stems from the way in which data are treated in it. As in so much of Forrester's

preceding work, data are treated casually, almost to the point of disdain. Thus, we learn that the distributions "agree generally with their historical values [presumably between 1900 and 1970] to the extent that we know them" (p. 125). But then, one would hope this to be the case since all curves were fitted to these same historical values. Moreover, "even in the absence of improved data, information now available is sufficient to generate valid basic behavior modes for the world system" (p. 121). Despite this *ex cathedra* judgment about the sufficiency of information, a worm of doubt entered my brain when I encountered Figure 15 (p. 72) that contains another of those terrifying exponential curves, this one, however, with clearly demarcated axes. It represents levels of atmospheric concentration of carbon dioxide over the period from 1860 through 2000. On close inspection, it turns out that the graph was fitted to observations taken at Mauna Loa annually between 1958 and 1970. In other words, a "behavior mode" was extrapolated from 13 data points both backward and forward in time to a total of 140. I tried to reproduce this experiment using least squares methods. The results were pleasing $(r^2 = .974)$, except for the fact that my projected carbon dioxide value for the year 2000 was considerably smaller (344) than that reported in Figure 15 (≈378). I find it exceedingly difficult to agree that the information available is sufficient "to generate valid basic behavior modes."

The authors' failure, as Forrester's failure before them, to investigate plausible alternatives among projection functions is sufficient cause alone to dismiss their works from the ranks of serious simulation research. Their claims that the model is insensitive to changes in the database are reasonable, but only given that the two major projection functions for population and capital are fixed. It remains for them to show that the outcomes are insensitive to changes in the projection functions themselves. This they failed to do, nor could they. Keyfitz (1968, Figure 9.1), for example, fitted exponential and logistic functions to census counting of the United States population (1800–1910) with approximately equal accuracy, but with drastically different projections of the future. Similarly, Boyd (1972) tinkered a bit with the equations of <u>World Dynamics</u> and thereby managed to convert Forrester's cataclysm into utopia.

When more than one family of functions is consistent with all available data series, then other criteria of choice must be involved. A social scientist would surely employ behavioral assumptions for this purpose. Thus, in a choice between exponential and logistic population projections (both empirically plausible), the assumptions that humans are able to recognize carrying capacities, are at least minimally rational and are capable of adjusting their reproductive schedule clearly would lead to the choice of the logistic and to a set of long-run projections that would be far less grim. The authors, of course, are not social scientists. In fact, I am hard pressed not to ask just what their credentials are for a project of this sort.

This lack of credentials in quantitative social science probably is at the root of my final complaint about <u>The Limits to Growth</u>. Its utter lack of sociological content has yielded a model of a world that no one knows. It is a world without social heterogeneity. Although the authors do make reference to inequality (p. 178–180), there is no place for it in the model. Thus, all nations, all people move to catastrophe or harmony at an identical pace. There are no haves and have nots simultaneously. There are no differences in demographic transition. Beyond world population size there are no demographic variables, nor any that are sociological; no occupational mobility because there is no job structure; no migration because of no geography; no dependent population, youth culture or geriatric problems because there is no age distribution; no social change because there is no social organization. These are among the major reasons why I find this to be a silly book.

Lest we conclude that this is the best that can be expected in macrosocial analysis, we should all reread the Population Commission Report (U. S. Commission on Population Growth and the American Future, 1972). The two works are similar in some basic respects: a concern with population dynamics, the use of projection techniques, the arrival at several common conclusions. Beyond that they are literally worlds apart. The Population Commission happens to deal with the one in which we live.

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