BOOKS: ENVIRONMENT

A Broad Look at Future Worlds

Carl Folke

Human actions now have the capacity to shape tomorrow's world, for better or for worse, as never before in history. Where is humanity heading—what destinations can we plausibly reach within the next half century? Addressing this question is the overall objective of Allen Hammond's thought-provoking book, *Which World? Scenarios for the 21st Century*. The author does not fall into the traps of trying to predict the future or simply extrapolating partial data, errors so common in the debates about development and environment. Instead, he recognizes that the world is complex and nonlinear, and that uncertainty and surprise are more the rule than the exception—making the future inherently unpredictable.

Which World? Scenarios for the 21st Century
by Allen Hammond
Island Press, Washington, DC, 1998. 320 pp. $24.95. ISBN 1-55963-575-4.

Which World? is a product of the "2050 Project" on long-term sustainability, a joint venture of the Brookings Institution, the Santa Fe Institute, and the World Resources Institute. Hammond, a member of the Global Scenario Group supported by the Stockholm Environment Institute and formerly editor-in-chief of the annual *World Resources* reports, has synthesized insights and information from a diversity of sources on seven major regions of the world.

A key point of the book is that our destinies can change; social attitudes can shift dramatically and many negative trends can be reversed if societies so choose and can summon the will to act. Deciding which actions are critical requires that we know more about what the future may hold. To this end, Hammond portrays three different scenarios—carefully posed stories—for human society and explores their implications.

In the "Market World: A New Golden Age of Prosperity," individual initiatives, technological change, economic growth, and global integration are the engines of development. In this scenario, free market forces and expansion of the global market through free trade bring prosperity, stability, and social progress to a larger and larger share of humanity. But we have heard this story before, and we know it is only partially true. Market prices seldom account for social realities or environmental necessities and are not good indicators of welfare or prosperity. Many believers in Adam Smith's invisible hand remain ignorant of the dependence of the global economy on the environmental resource base, and do not recognize that it is the content of growth—not economic growth as such—that matters (*1*).

Choosing the market world, with its partial truths, is to unwittingly play a too risky game and to promote a global monoculture of the mind that may throw humanity into the "Fortress World of Instability and Violence." This fundamentally pessimistic scenario holds that unconstrained markets will eventually destroy the environment and the social frameworks on which they depend. I leave it to the readers to imagine the consequences.

The solution, although not promoted as such in the book, lies in the "Transformed World: Changing the Human Endeavor." Here fundamental social and political change gives rise to enlightened policies and voluntary actions that direct and supplement market forces. A complex web of effective institutions (incorporating basic property rights, well-run legal systems, and uncorrupt bureaucracies) is in place. Cultural norms and values are modified, and humans are seen as a part of, not apart from, nature. Hammond argues that such fundamental social and political changes for a better world are already on the way, as attested by the greening of global corporations, altered governmental policies, the rise of citizens groups, and a new age of philanthropy.

In the book, four sets of critical trends—demographic, economic, and technological; environmental; security; social and political—are comprehensively analyzed region by region in the context of the three scenarios. Lacking is a more explicit treatment of how the trends may influence one another, by feedback among the scenarios and regions. For example, demographic and economic trends in one region might cause environmental change influencing security elsewhere. Furthermore, looking at trends is not sufficient. To shape the future, we also need to understand, respond to, and actively manage processes of change. Certainly, with increasingly interdependent human activities and a population that may exceed 9 billion in the year 2050, we must learn to live in a complex world that is even less predictable than the present one. It is thus critical that societies learn how to respond to feedback in the combined system of humans and nature (*2*).

Hammond's purpose in writing this book is to illustrate that it is possible for human societies to create more positive futures for themselves. *Which World?* is not about predicting the future. We cannot predict the future, but we can shape it. The distinction is very important and well stated throughout the book. But social choices are not independent of the environmental preconditions for human well-being. This important point is present in the book, but could have been made more clear. Nevertheless, Hammond offers an excellent contribution to the growing literature on the human predicament and the challenge of sustaining the Earth's legacy. The book will open the eyes of the ignorant, and fulfill its purpose of stimulating further thought and action.

The author is in the Department of Systems Ecology, Stockholm University, SE-106 91 Stockholm, Sweden, and at The Beijer International Institute of Ecological Economics, Royal Swedish Academy of Sciences, Post Office Box 50005, SE-104 05 Stockholm, Sweden. E-mail: Carl@beijer.kva.se

References
1. K. Arrow *et al.*, *Science* **268**, 520 (1995).
2. L. Gunderson, C. S. Holling, S. Light, Eds., *Barriers and Bridges to the Renewal of Ecosystems and Institutions* (Columbia Univ. Press, New York, 1995); F. Berkes and C. Folke, Eds., *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience* (Cambridge Univ. Press, Cambridge, 1998).

BOOKS: HISTORY OF SCIENCE

Atomic Philosophies

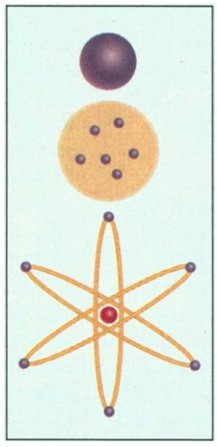
Diana Barkan

There is a long and respected tradition among scientists, and among chemists in particular, to devote some time in retirement to writing on the history and development of their field. Generally, as for most history of science (even that practiced by professional historians), such writings tend to fall into one of two types: those that stress innovation, progress, and revolution or those that emphasize continuity and recurrent themes across time and space.

The Atom in the History of Human Thought
by Bernard Pullman
Translated by Axel Reisinger
Oxford University Press, New York, 1998. 414 pp. $30, £25. ISBN 0-19-511447-7.

Bernard Pullman's book tries to do both. *The Atom in the History of Human*

The author is in the Division of Humanities and Social Sciences, Californina Institute of Technology, 228–77, Pasadena, CA 91125, USA. E-mail: dibar@cco.caltech.edu



Thought is an ambitious project by the late professor of quantum chemistry at the Sorbonne and director of the Institut de Biologie Physico-Chimique, who died in 1996 at the age of 77. Over the last four decades, Pullman has edited or co-edited more than 40 major scientific books and collections in chemistry, physical chemistry, photochemistry, biochemistry, and cancer research, many of them in collaboration with his wife, Professor Alberte Pullman. This, his last book, is, according to historian of science Gerald Holton, "an engrossing and civilizing work."

The story of the atomic theory of matter lends itself better than almost any other historical journey to a grand panoramic approach to the history of scientific ideas. Following the approach of many of his French intellectual colleagues, Pullman has chosen to trace the history of the concept of the atom not primarily in the work of scientists, but rather largely in that of philosophers and other important critics. He follows the ideas of the atom through the long period of 2500 years since the notion of an indivisible fundamental constituent of matter was first formulated by the pre-Socratic Greek thinkers. A major theme that animates the book is the recurring tension between theology and science, reflected in the attempts by various Christian, Arab, Indian, and Jewish thinkers to either incorporate or reject atomism. The book's strength lies in its encompassing range and its accessibility to a wide audience. Much primary material is analyzed in extensive quotations, from the *Guide to the Perplexed* by the 12th-century physician, theologian, and philosopher Moses Maimonides to fascinating daydreams such as Diderot's moving and poetic letter to his beloved Sophie, in which he hoped that upon death "it were my fate to be one with you through the course of the centuries, if the molecules of your erstwhile lover were destined to become inspired, aroused, and to seek yours scattered in nature!"

Pullman uses texts to tease out what may or may not have survived from the ancients and the pre-moderns into our own contemporary conceptions. He is, unsurprisingly, at his best when dealing with recent developments in the physics and chemistry of atoms and nuclei, where he leaves no loose threads unexamined. If indeed Democritus was right in imagining that matter and energy are one, his notion of the void, which Descartes opposed so fiercely, has no longer survived unchallenged.

Pullman is sympathetic to most of the protagonists in his book, atomists and anti-atomists alike, although he often judges their views in light of current scientific practices and theories—as if seeking to uncover eternal truths that he believes should have been self-evident. There is thus, implicit in this work, an urge to connect with the past, to construct a narrative of progress, and to weed out mistakes and missteps. Yet, it is an eminently readable and enjoyable book, which affords perspicacious insights into one of the most persisting scientific problems. Shall we say that atoms truly exist, indivisible and eternal? Pullman does not really tell us. Perhaps because we now have the elementary particle "zoo," and the philosophers in all of us may continue the discussion unabated.

NEW MEDIA: SOFTWARE

An Uneasy Marriage

Bruce McCallum

Origin is the preeminent data analysis and graphics software package available for a Windows environment. This software can be used for data plotting, graphics, and curve fitting (drawing curves through data points). Earlier versions of Origin had severely limited data management options in the worksheet portion of the program. It was with great anticipation, therefore, that I examined version 5.0, which integrates Origin with the spreadsheet features of Microsoft's Excel and the presentation features of PowerPoint.

Origin 5.0
by Microcal Software Inc.
Northampton, MA.
$595; $200, upgrades
Phone: 800-969-7720
www.microcal.com

Origin 5.0 requires Microsoft Windows 95 or Windows NT (4.0 running on a 486/DX or higher processor with 8 MB RAM). To obtain the full functionality of Excel, Microsoft Office 95 (Excel 7) and OLE2 must be installed, at a minimum. Origin runs as a server for OLE (object linking and embedding)–compliant applications such as PowerPoint, which means that PowerPoint can open Origin for editing an object within itself.

Version 5 contains several new features that make it easier to use, such as dockable toolbars, tabbed options boxes, and new formatting controls for axes. Origin's nonlinear curve-fitting menu has a new set of built-in pharmacological functions that enable users to calculate dose-response curves, one- and two-site competitive binding and biphasic effects in conjunction with a simultaneous graphical representations. Complex graphs can be designed with the layer control, which manipulates plots down to the level of individual data points and text characters.

Origin runs as an OLE server for OLE-compliant applications, such as PowerPoint. This means that Origin's graphing tools can be used to edit an Origin graph embedded in a PowerPoint file. OLE also enables users to directly utilize Excel data sets and spreadsheet functions while in Origin. Changes made to Excel workbooks can be saved either inside Origin projects or dynamically linked to Excel spreadsheets outside Origin over networked servers. Origin saves changes to external workbooks in both the Origin client file and the Excel host file. According to Microcal technical support, occasional installations of Excel will not communicate with Origin (they are working on this bug with Microsoft).

Some Excel spreadsheet functions can be used within Origin, including in-cell editing, relative and absolute cross-referencing, filling a multi-cell selection with a range of values or an array of formulas, and multiple worksheets in one workbook. However, the integration of Excel is incomplete. Users must still use the relatively cumbersome Origin syntax to plot data in a graphical format. Origin plots data from columns only, and the y data must fall within the same row range as the associated x data. The only Origin menus available when an Excel workbook is active are the File, Plot, and Window menus. Curve-fitting functions are not available when Excel workbooks are active. Excel macros can be used inside Origin, but they have to be called with Origin's macro language, LabTalk.

The marriage of Origin to Excel compromises some of the functionality of each program. For the cost of this upgrade for Origin, users may reasonably expect more extensive spreadsheet integration, such as plotting from rows (as well as columns) and fitting data within an Excel workbook. A statistical module would be useful to complement the set of hypothesis-testing routines that are currently limited to t tests, one-way analysis of variance, and multiple regression. Despite these shortcomings, OLE implementation in Origin provides welcome enhancements, as noted above, and marks a pathway for future program development.

The author is in the Department of Anesthesiology, Medical College of Wisconsin, 8701 Watertown Plank Road, Milwaukee, WI 53226, USA. E-mail: mccallum@post.its.mcw.edu