

which resurrects the Goethean "ideal of humanity" as an ally and talisman. I have nothing against productive misunderstandings, which make the world go round; but surely there are better objects for misunderstanding. I still remember clearly the years I spent rummaging through the alchemical, gnostic and occult sources of Goethe's symbolism in *Elective Affinities* and its roots in his chemical studies with Schelling, but far more clearly the comments of a German colleague: "John, you may be right, I suspect you are - but if you are, it's not worth reading the novel". I abandoned the project: Engels' "triumph of realism" had struck again. Goethe's literary works still fascinate us despite the conservative and ultimately inhumane mysticism that underlies them; the study of his scientific works may provide important and sometimes unwelcome insights into the bases of this underlying "world view", but its relevance to contemporary debates was as unclear to me after reading the book as before. This is at least partly due to the ahistorical approach of many of the essays, which seem to regard science, and philosophy of science, as some kind of timeless continuum. I searched in vain for any attempt to derive Goethe's views from, or even relate them to, their socio-historical context.

My own prejudice in favour of an approach based on the historical sociology of knowledge was only strengthened by this "reappraisal"; Goethe's scientific views are interesting not in themselves, but in the broader perspective of the "deeds and sufferings" of modern science, its *social history*. Even his emphasis on "cognition", which seems at first glance to provide a link to recent fashions, is deceptive: as the editors admit, his sympathy with them is unlikely. The symbolic hierarchies that underlie his work look backward rather than forward. Although this excellently and conscientiously produced book, with its useful bibliography, will no doubt attract the interest of many Goetheans, particularly of the anthroposophic persuasion, its usefulness as a contribution to the reorientation of scientific discourse is more than questionable.

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Margaret A. Strom (ed.), *Societal Issues: Scientific Viewpoints*. New York: American Institute of Physics, 1987. US\$41.25 (hb), US\$31.25 (pb).

Though not its intended purpose, this volume provides a telling picture of the worldview of elite United States scientists. The editor, who taught writing to engineers and scientists, sought a collection of readings on social issues to trigger the thinking and writing of the students. Finding none suitable, she invited numerous leading scientists and engineers to submit pieces for this anthology on social issues.

So here are some 46 scientist authors, mostly in their role as socially concerned intellectuals and citizens. Their contributions span a range of topics from education to overpopulation. Nuclear war is a favourite focus, but also covered are famine in the Third World, space travel, professional ethics, energy policy,

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published before, in a variety of journals, and many others were speeches. There are also some sermons and poems.

What will science students learn from this collection of earnest writings by top scientists? The unspoken messages are mostly predictable to metascientists, but worth recounting.

Most obviously, the collection is dominated by engineers and natural scientists. Apparently a "scientific viewpoint" on a "societal issue" is the view of someone who has achieved fame in the natural sciences. Social scientists are conspicuous by their absence. Furthermore, hardly a single author has taken the trouble to examine what social scientists might say about social issues. (Interestingly, the humanities are treated more favourably, with a number of contributors dropping names of classic thinkers and supporting education in the humanities.)

The attitude seems to be that if one can succeed at solving scientific problems, one can use the same techniques of 'critical thinking' to tackle social problems. This is apparent in the many pieces on nuclear war, where a 'logical' analysis of the nuclear arms race, deterrence and so forth is the norm. Analyses by scientists such as Victor Weisskopf, Hans Bethe and Andrei Sakharov follow a standard set of assumptions: nations are unitary actors, there are two sides, and national military policies should operate on the basis of logic. There is hardly a mention of peace movements. Clearly, these writers, while certainly sincerely concerned about the problem of nuclear war, are caught up in using the orthodox conceptual tools of nuclear strategists. That there might be other types of analysis is not mentioned.

This volume also appears to testify to the failure of the metascientific community to have any impact on the thinking of leading United States scientists. An exception is Alvin Weinberg, who cites Pinch and Bijker on "The Social Construction of Facts and Artefacts" - but only to dismiss such analysis as a "caricature of science". Andre Courmand cites Stephen Brush's "Should the History of Science be Rated X?" - again to dismiss it.

The lack of any critical dimension is consistent. For example, there is a long article by Jay Forrester on world modelling, but nothing about the now well-known limitations of such modelling. Of greater concern is the fact that not a single author hints that one's own role and experiences as a scientist might influence one's attitudes towards science and social problems.

Another message of this book is that the United States is the only country in the world that counts. Foreign viewpoints and foreign authors are again conspicuous by their absence. This parochialism is unfortunately typical of a great deal of US intellectual work. The exception is Andrei Sakharov, who has a special section. Still, he seems to be an honorary American, and certainly his view of the world is little different from others included here.

Needless to say, the 'standard' view of science, as something objective and useful for humanity if applied correctly, predominates. But the collection is quite varied, and for every generalisation above there are exceptions. A few of the articles are politically sophisticated and avoid scientism.

For metascientists, one message of this book may be that more effort is needed to communicate in ways and in arenas which get through to scientists and science students in the United States. Articles published in *Science* or *Bulletin of the Atomic*

and reflections on the scientific life. The authors are mostly senior male scientists, including 12 Nobel Prize winners. About two-thirds of the writings have been Scientists, on contemporary social issues or just on the nature of science, can be very influential. The task of breaking into such journals is formidable if one is not a (famous) scientist, does not accept the standard view of science, and is outside the United States. The effort may be worthwhile nevertheless.

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History of Physical Sciences and Technology

Hans Blumenberg, *The Genesis of the Copernican World*, trans. Robert M. Wallace. Cambridge, Mass: MIT Press, 1987. US\$40.00 (hb).

This is the third of Blumenberg's books to appear in English, and the one of most direct interest to historians and philosophers of science. In his earlier book, *The Legitimacy of the Modern Age* (MIT Press, 1983), Blumenberg attempted to show, amongst other things, that the distinctive intellectual problems of the modern era are legitimate in their own right and are by no means simply the result of secularization of religious concerns of the Middle Ages, as Löwith and others have argued. In the course of showing this, Blumenberg focuses on the question of how modernity came about, and this, he argues in detail (some 700 pages of detail), should be seen in terms of overcoming the problem of how a transcendent God can be responsible for human affairs. Augustine had tried to respond to the Manichaean treatment of this problem (which led to the distinction between the evil God of creation and the good God of salvation) in a way which retained the single God of Christianity, and this he achieved by making human beings wholly responsible for evil. But Augustine's solution was itself always problematic, since it opened up a gulf between Divine and human affairs. The gulf finally became unbridgeable with the Condemnation of 1277, which removed all limits from God's power, something which had the effect of making human beings powerless. Blumenberg's argument is that modernity emerges from the successful resolution of the problem, a resolution that involves the emancipation of humanity.

The Genesis of the Copernican World takes up a number of themes of the earlier book and focuses on the conditions of possibility of Copernicanism, and the question of what Copernicanism amounts to in a broad cultural context. Blumenberg ties together the Copernican reform of astronomy and the institution of modernity, not by arguing that there is a causal connection between the two, but by showing that, even though they are different sorts of event, the same kinds of thing contribute to making them possible. At the historiographical level, this involves the incorporation of the history of science into the 'history of consciousness' (*Geistesgeschichte*), an extremely problematic enterprise full of the dangers of reductionism, relativism, and failure to grasp what is specific to scientific