BOOK REVIEWS

Rangings of the Mind

Scientific Literacy and the Myth of the Scientific Method. HENRY H. BAUER. University of Illinois Press, Urbana, 1992. x, 180 pp. $24.95.

Simplicity and Complexity in Games of the Intellect. LAWRENCE B. SLOBODKIN. Harvard University Press, Cambridge, MA, 1992. vi, 266 pp. $24.95.

It is not uncommon, these days, to find on the bookstore shelves books written by scientists about their science for a lay audience. These two books are of a different nature, however. These are books written by scientists about issues that may grow out of the substance of their own work but that encompass much broader concerns. One book is about the nature of science itself, and the other is about science and just about everything else.

Henry H. Bauer's *Scientific Literacy and the Myth of the Scientific Method* is sound, sensible, rather leisurely in pace, and very easy to read. Bauer's central point is that the much-vaunted Scientific Method doesn't really exist and that the false belief in its existence has led to many popular misconceptions, which he happily sets about to skewer. Bauer, who is a chemist, former dean, and participant in the Center for the Study of Science in Society at Virginia Polytechnic Institute and State University, is not all negative, however. He does have his own view of how and why science does work, which he sets out for us in a chapter modestly titled "How science really works."

For Bauer, science is a complex human activity, best described by the dual metaphors of the puzzle and the filter. The puzzle analogy, which he adopts from Michael Polanyi, represents science as the activity of piecing together a jigsaw puzzle by many workers, each in full view of all the others. Science stays on track not because of any magic scientific method but just because any piece that doesn't fit can't be used. According to Bauer's other metaphor, the Knowledge Filter, science starts out with all kinds of undifferentiated elements, then successively filters out those parts that are not true, starting from Frontier Science, which is necessarily volatile and unreliable, and proceeding by stages to Textbook Science, which is almost surely correct. Bauer has apparently read all the right philosophers, from Bacon to Popper to Feyerabend, and doesn't much agree with any of them. Not for him the subtle machinations of pure logic, inductivism, falsificationism, relativism. Science is a consensual, community activity, tempered by "reality therapy." He has no doubt there is a puzzle out there waiting for the last piece to be put in place.

Bauer is fond of metaphors. In addition to the puzzle and the filter, he sees science as a map of reality, schematic but useful for getting from place to place, and dependable only within its borders, not outside. He also sees much in common between the modern scientific establishment, which he regards as being under siege (owing to all those misconceptions), and the Church at the time of the Reformation.

Among the popular misconceptions is that

Example of a mandala: "A German medal of 1936 honoring the discoverer of a system of knowledge." [From *Simplicity and Complexity in Games of the Intellect*]

indicated by the use of "scientific" as an adjective to modify "fact." It is axiomatic among students of STS (I'll get back to STS in a moment), Bauer says repeatedly, that facts are theory-laden. Because the public thinks that science deals in facts, it gets upset when science changes its mind, for example, about the age of the earth, a point much exploited by creationists. The public doesn't understand the difference between frontier science (which must be able to change) and textbook science (which doesn't change very much). In quite a different arena, the current public concern with scientific fraud is misplaced because all fraud takes place in frontier science, which is undependable anyway. There's little chance that the periodic table of the elements is a mistake based on fraudulent information. Not that misconduct in science is a trivial matter; Bauer rightly points out that we are naïve to think the (mythical) scientific method makes it unnecessary for us to formulate a professional code of ethics.

The book does have one weakness, not an important one, but slightly disconcerting. It occasionally seems to descend into special pleading. For example, in the otherwise excellent chapter called "The so-called scientific method" Bauer lets his argument about the diversity of the sciences become something of a diatribe against the primacy of physics among them. In my experience, that is not an uncommon hobbyhorse among chemists. More important, the book sometimes seems to become a sales pitch for an academic program called Science, Technology, and Society (that's what STS stands for). Thus, in the chapter on science literacy, after correctly pointing out that the problem, if it is one, won't be cured by requiring students to take more science courses, Bauer goes on to say (incorrectly in my judgment) that the best solution is to require all students to take STS.

Bauer's intellectual heroes seem to be Polanyi and John Ziman (oh dear, a physicist!), whom he quotes often. He ranges wide and is usually right on target. I would strongly recommend this book to anyone who hasn't yet heard that the scientific method is a myth. Apparently there are still lots of those folks around. Also, given the annotated "notes on science" for each chapter (at the back of the book—there are no footnotes), maybe the book can serve as a text for a course in STS, whatever that is.

From Lawrence Slobodkin's *Simplicity and Complexity in Games of the Intellect*, we learn that a Mahayan Buddhist mandala is an object designed to aid contemplation, too complicated to be taken in at a single look but designed for a pedagogic purpose. Much the same may be said of Slobodkin's book. His central theme seems to be that we humans (and maybe some of our nonhuman cousins) have a deep-seated need, for both intellectual and aesthetic reasons, to simplify the complex world our sensory organs present to us, but that simplification tends to create a kind of intellectual vacuum that we fill with its opposite, elaboration. The basic outline of the book is to examine how this scheme works out in religion, games, dining, art, and science.

That, however, is much too simple. Slobodkin's style does not run to incisive analysis or the marshaling of compelling argument. Rather, it is discursive, associative, sinuous. We learn about mandalas, for example, not in a chapter about religion,

nor in one about art, but rather in one about science. Why? I would be hard pressed to explain, except that, I think, Slobodkin has purposely made his book an example of his thesis. Its outline is simple, but the complicated substance of it bears little relation to the outline.

Sometimes his thesis does illuminate the subject matter. Thus, on the "religions of the book," Judaism, Christianity, and Islam: Judaism cast off the complex theology of preexisting polytheism, a significant simplification, but substituted for it a legal system of endless detail. Christianity (eventually) replaced the Jewish legal code with a few simple ethical principles but compensated by creating a theology complex enough to keep its philosophers busy. Islam, in its turn, banished theological complexity but returned to a detailed, legalistic code of behavior.

Games are an obvious example of simplification. All players, rich and poor, are (in principle at least) equal on the playing field, and, for once in life, everyone knows the rules. But games take place in, and are always related to, the larger, more complicated world outside the playing field. The prize for winning is almost always something that is not useful within the game itself.

This brings us to a discussion of three dinner parties. (How? Please, don't ask.) One is a lavish Italian dinner, the second an elegant Japanese lunch, and the third a Passover Seder in Slobodkin's own home. The Seder, a ritual dinner, is full of symbolic foods and activities, obvious simplifications of complex tribal memories, complemented by notable elaborations of food and custom. The Japanese lunch brings to light the Japanese chef's ideal (very different from that of the Western chef) to be transparent, not to intrude between the diner and the ingredients (the same idea will later reappear in the wish of a musician not to intrude between the audience and the composer). The Italian dinner took place in Pavia, where Slobodkin was obviously the honored guest of a cultured and well-off host. It is the standard Italian meal: antipasto, pasta course, fish course, meat course, all with appropriate wines and other accompaniments, and two rich desserts. Judging by Slobodkin's description of the food, conversation (mainly about food), and the rest of the dinner scene, I would rate him a dependable reporter (this review is being written in the town of Grottaferrata, just outside Rome).

To continue through the book chapter by chapter would be to do Slobodkin an injustice, because the book would then seem to be summarized, and it is not a book that submits easily to summary. It is a meandering discourse, loaded with specific stories and facts (Slobodkin calls them his "menagerie of examples"). For example, people who have their natural lenses re-

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moved because of cataracts can then see in the infrared (I didn't know that). Most of his examples are less mundane, showing (and showing off) Slobodkin's broad erudition in art, music, literature, religion, and, of course, science (Slobodkin is a professor of biology at the State University of New York at Stony Brook). His writing style is sometimes a bit pedantic. Instead of saying it ain't wise to beat the boss at golf, he describes "the golf game between a boss and an employee in which there are economic penalties to the employee if he wins." He is also constantly telling us what the next few chapters hold in store. On the other hand, he can be amusingly ironic: "There are also places in which whole groups can reject most of the world's flow of information—bars, synagogues and churches, congressional and parliament buildings, sailboats, squash courts, and the better colleges."

This is a very personal book, and, perhaps inevitably, we learn as we go along a great deal about the author: he grew up in the East Bronx, has a three-year-old grandson, has a dog but doesn't like cats, and so on. In fact, in the end, whether you like the book or not will depend on whether or not you come to like the author, with all his menagerie of stories and his idiosyncrasies. He ends his introduction by saying, "I hope you have as much pleasure in the reading as I had in the writing." Not all readers will get quite that much pleasure out of the book. Nevertheless, many will find it worth the price of admission.

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Technocultures

Strange Weather. Culture, Science, and Technology in the Age of Limits. ANDREW ROSS. Verso, New York, 1991. viii, 275 pp., illus. $29.95; paper, $16.95. Haymarket Series.

The usual way of thinking about technology and the scientific knowledge that undergirds it is to regard them as mere tools, value-free instruments with which we accomplish tasks. Andrew Ross in *Strange Weather* sees technology and science a different way, both as products and as shapers of cultures. The book has many goals, as literature, political judgment, and interpretation regarding connections among power, meaning, culture, and technology. Space limitations and predilection lead me to neglect his literary efforts, and most of his political ones as well.

The book is cultural criticism, focusing on what Ross calls oppositional technocultures. Though not formally defined, oppositional technocultures are values and beliefs adopted by certain strata or groups that claim to contest "official scientific cultures." They are, in other words, people who are concerned with science and technology but who oppose institutionalized science and who dispute, on the surface at least, expert authority. Ross's cultural stories are about New Age, computer hacking, cyberpunk, science fiction, and futurology, to mention but a few.

The beliefs and values of all the cultures Ross dissects are too numerous and too disparate—and his analyses too intricate—to explicate in a review. I'll describe two of them and Ross's reading of them to give you a flavor of what the book tries to do (the book has six chapters, each devoted to one major technoculture, though each chapter has ruminations on many themes).

New Age ideology emphasizes individual rather than collective well-being and asserts a holism between body and mind. In their search for holism New Agers talk of channeling and brain gyms, of altering brain waves to "balance the left and right brain in holistic synchrony" (p. 31). New Agism insists on the inseparability of physical and spiritual realities, which suggests the notion that the body itself has intelligence. This raises the possibility of communicating with inner as well as outer space. As Ross puts it with characteristic wit, "Talking with DNA is the corollary of talking with E.T." (p. 35). New Age thinking claims that Western science, with a narrow, overly technical way of understanding, wrenches illness and disease out of context, which limits its ability to enhance health and well-being. There are even some New Agers who maintain that it is not AIDS that makes people ill but "our negative overreaction to the virus" (p. 51).

How to interpret such stuff? Ross urges us not to dismiss such notions out of hand but to look for the deeper meanings indicated by countercultural claims. To be clear, Ross does not celebrate New Age ideology, or any of the other ideologies he interprets. Indeed, he is just as critical of oppositional cultures as he is of "the dominant scientific paradigm." He points out, for instance, that, rather than advancing an alternative worldview, New Age has developed a conception of rationality that complements rather than opposes established scientific culture. New Age ideas, then, "at once contest and reinforce dominant values about human and technological growth and development" (p. 21).

Ross finds politics in places most of us wouldn't think to look. His political interpretation of computer hacking is especially clever. Consider, for example, the 1988 computer virus spawned by Cornell student Robert Morris, which infected the DARPA network via Internet. The attack signaled increased media, corporate, and legal attention to electronic breaking and entering. It also spurred "viral hysteria," which has in turn engendered two main effects. First, the hysteria helped produce a "windfall for software producers" of both anti-virus programs and the programs vaccines are meant to protect. Second, virus hysteria nourishes the view that information, along with information technology, is naturally a proprietary matter. Yet it was the hacker counterculture that pioneered the personal computer revolution in the first place, and that counterculture was based on shareware, copying, and open architecture. Ross goes further, exploring how hackers, once defined as daring innovators, came to be defined as a new class of deviants, even enemies of the state. The insight here is that hacking has come to be seen as a problem of "trespass," which restricts public, legislative, and political discussion about hacking to issues of privacy and private property. The problem, from Ross's point of view, is that such a restriction "closes off any examination of corporate owners' and institutional sponsors' information technology activities" (p. 83).

Thus in Ross's hands hacking is much more than deviant pranksterism. Hacking is a fundamentally social and political act, one that challenges dominant institutions because it denies official definitions of knowledge ownership. It is not fortuitous that hackers' most prized targets are the police, defense agencies, and other agents of the institutional world. Hackers hew to an ideology that is libertarian in its approach to technology and knowledge. They want to decentralize it, open it to a wider circle of consumers. Ever ironic, however, Ross notes that hackers not only challenge but support dominant culture. That is, even as they engage in digital class struggle, hackers adopt an American, high-tech work ethic, one that celebrates "high productivity, maverick forms of creative work energy, and . . . on-line endurance" (p. 90).

Ross's critical analyses of different visions of the future created by alternative technocultures is interesting. His lucid, carefully reasoned arguments will enlighten anyone concerned with science, technology, and culture. The stories, which demonstrate the creativity and even rationality of out-of-the-mainstream groups, should entertain scientists and humanists alike.

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