and the embarrassment caused by interpreting US Department of Agriculture data for weekly averages as "Sunday closing prices." There are many fascinating asides on a variety of topics, ranging from the importance of computer graphics in science to the distribution of insurance claims resulting from fire damage. In some places, the format of reprinted (but slightly edited) versions of classic papers allows Mandelbrot the surreal luxury of reviewing not only the content, but also the style and presentation of his work. And if all this were not enough, there are guest contributions from Eugene Fama, Paul Cootner and others.

This volume is not intended to be a textbook of modern finance, and it will probably infuriate those seeking a balanced and systematic exposition. Some readers will be irritated by the admitted redundancy of the text and frequent lapses into informality. My favorite is the caveat on page 232: "Due to time pressure, the algebra in this section has not been checked through, and misprints may have evaded attention." Indeed, I noticed many misprints, but to criticize the volume on that account would be churlish. The reader who is open-minded and prepared to indulge one of our more influential and original thinkers will be amply rewarded.

All in all, this is a strange but wonderful book. It will not suit everyone's taste but will almost surely teach every reader something new. What more can one ask?

What Is Mathematics, Really?

Reuben Hersh
Oxford U. P., New York, 1997. 343 pp. $35.00 hc
ISBN 0-19-511368-3

What Is Mathematics, Really? is not an introduction to the practice of mathematics. Nor is it a description of some of the interesting projects that currently occupy mathematicians. Nor is it a compendium of engaging puzzles and paradoxes. It does not fit the same mold as most of the books on the subject that are—either supposedly or actually—addressed to the lay public. Rather, it takes on precisely the question posed in the title, and this at the deepest, most metaphysical level.

In his attempts to characterize what mathematics precisely *is*, Reuben Hersh describes and comments on the various answers that have been proposed over the millennia. Among the schools of thought discussed are Platonism, which insists on the intrinsic reality of numbers and other mathematical notions, and formalism, which focuses on the "rule structure" of the subject and in fact (according to Hersh) discards all other aspects of mathematics.

Hersh rejects these two influential philosophical approaches in favor of a "social-historic cultural" characterization of the activity. To his credit, he lays his cards on the table. At the end of the first chapter, he sets forth two assertions: that mathematics is a "social-historic reality" and that there is no need to inquire beyond the social, historical and cultural meaning of mathematics. He points out that the first statement is almost a truism. The second is clearly controversial—ask anyone with a nodding acquaintance with the so-called culture wars surrounding modern critiques of science.

Hersh is anything but an enemy of conventional mathematics. A working mathematician and teacher, he evinces the highest respect for those in the trenches. His argument with much that has been said about mathematics is that it does not respect what actually goes on when a mathematician tries to advance the field.

Reading this book with an unjaundiced eye (and in the absence of a background in the subject beyond vague recollections of a semester-long introduction to metaphysics), I found it easy to sympathize with Hersh. The Platonic approach, taken literally, seems just a little far-fetched, and the claim of the formalists that all of mathematics reduces to set theory strikes me as an exercise in hubris. On the other hand, I am not particularly happy with the possibility that mathematics may not be about eternal verities, a prospect that Hersh accepts with equanimity. He likens the acceptance of the notion of mutable, dubitable mathematics to the expansion of the real number system required to accommodate the square root of minus one. While the analogy intrigues, I am afraid that I do not find the comparison of imaginary numbers to fictive mathematics particularly persuasive. Nevertheless, one cannot dismiss this proposal out of hand, and it is undeniably provocative.

There is a good deal more to *What Is Mathematics, Really?* than is mentioned above. A sizable portion of the book is devoted to thumbnail sketches of what has been said about mathematics by the most influential thinkers in the Western world, from Pythagoras, Plato and Aristotle, through Saint Augustine, Descartes, Kant, Hilbert and Russell, to contemporary commentators. Hersh's generally lucid descriptions of their reflections and views are often accompanied by parenthetical comments. Most are illuminating; some strike me as facile and possibly unfair. On the whole, however, it appears to me that the book does justice to the various attempts to understand the mathematical enterprise.

Other sections include thought-provoking discussions of intellectual processes that constitute mathematical thinking, primers on important concepts and trends, a list of criteria—essential, desirable and dispensable—for a philosophy of mathematics. The final section of the book consists of over 50 pages of background notes on mathematics. In many respects, reading this section was the highlight of my experience with *What Is Mathematics, Really?* Hersh has a talent for exposition that makes me wish he had written most of the books on math I've had to read.

My own discipline—physics—has its share of anomalies and puzzles, and the question of the nature of mathematics has direct relevance for those interested in what it is—really—that a physicist does. Reuben Hersh's fascinating, if not always satisfying, book should prove an enlightening and entertaining read for anyone who desires greater insight into the nature of the pursuit of fundamental knowledge.

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Traces of the Past: Unraveling the Secrets of Archaeology through Chemistry

Joseph B. Lambert
Helix Books (Addison-Wesley), Reading, Mass., 1997. 319 pp. $30.00 hc ISBN 0-201-40928-3

Joseph Lambert is a distinguished practitioner of the relatively new field of archaeometry. In *Traces of the Past: Unraveling the Secrets of Archaeology through Chemistry*, he sets forth comprehensively the wide-ranging scope of that discipline insofar as chemical research is involved. In the process, he recounts the often-startling results produced by the partnership between the chemist and the archaeologist. This gem of a book focuses on chemistry and the extraordinarily close match between the interests and skills of the chemist and the needs of the archaeologist to interpret the results of field work—what comes out of the excavation.

Chemical analytical laboratory studies are now a routine feature of an archaeological dig, and Lambert, by and large, deals with the whole gamut