The book is attractively printed and put together. It is ingeniously arranged for ease of consultation by taxonomists. The ethnologist, the social historian, the general student of the Southwest will find the index maddeningly inadequate. *Aguamiel,* for instance, does not appear at all in the index, and the reference to cactus candy is hidden (to all but the initiated) under *Opuntia.* However, the book is such a rich mine of all kinds of information that a first-class index would have been just one more major project.

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Philosophy of Science. Gustav Bergmann. University of Wisconsin Press, Madison, 1957. 181 pp. $4.75.

Originally planned as the foundation section of a volume on the philosophy of psychology, *Philosophy of Science* focuses on those ideas considered by the author to be indispensable for logical analysis of the behavioral sciences. Despite this orientation, the book will be of interest to philosophers generally and to philosophically minded scientists in other domains, for, aside from analyses of physical concepts by way of paradigm, Gustav Bergmann provides an introduction to notions such as "deduction," "existence," "definition," and "number"; recurrent remarks on philosophic analysis by means of schematic representation in "improved" languages; and a general discussion of description and explanation in science.

Of special significance in connection with the latter topics is the author's fruitful characterization of types of scientific law, including what are called "process," "cross-sectional," "equilibrium," "developmental," "statistical," "historical," and "composition" laws. The subject of composition laws introduces Bergmann's illuminating analyses of a whole cluster of problems, which have figured importantly in psychology and the social sciences, concerning *Gestalt,* holism, emergence, and reduction. Not the least valuable feature of these analyses is the pinpointing of ambiguities in key terms such as *whole* and *additive*—ambiguities crucial to their philosophic use by some writers.

Rather disconcerting is Bergmann's omission of adequate citation to related literature, and even more so are his occasional controversial comments on authors whose views are neither quoted nor specifically cited, notably John Dewey. But most disturbing to me are the flat judgments thrown out offhandedly on difficult issues. Thus, to take two examples, we are told (page 40) that "the ideal language, by the way, is 'phenomenalistic'" and (page 87) that, while there has been "a good deal of talk, in the nether regions of the intellectual universe" to the effect that recent physics has given up Newtonian mechanism and determinism, "it is worth mentioning . . . that these views are also thoroughly mistaken." This last is doubly disturbing when we learn (page 124) that quantum phenomena "form an area of relative chance," and that our idea of the physical universe, though deterministic, is not mechanistic, as Newton's was, in one sense clearly specified in the text.

Bergmann's logical framework is not nearly so subtle as some of his analyses of physical and psychological issues. Readers will find it impossible to tell, from his treatment alone, how controversial his logical-descriptive and analytic-synthetic dichotomies have become in recent discussions. Nor does Bergmann, in the face of a history of critical treatments, qualify his pronouncement of the existence of simple and complex properties and relations named by descriptive words—an affirmation which, incidentally, seems to conflict with the extensionality he appears to espouse (page 55). And, in place of various philosophic methods suitable for a variety of purposes, he frankly searches for an "ideal language" in which *everything* can be stated and *all* philosophic problems can be analyzed. Despite these strictures on his general framework, it must be said that his specific analyses of explanation, law, and holism stand pretty much on their own feet and are, moreover, enlightening and suggestive. It is to be hoped that they will be widely and seriously studied.

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A History of Technology. vol. II. *The Mediterranean Civilizations and the Middle Ages.* Charles Singer *et al.* Clarendon Press, Oxford, 1957. 802 pp. Illus. $26.90.

It is with great pleasure that we receive this, the second of five projected volumes of essays on the history of technology, all written by experts and admirably edited by competent historians. As the world speeds on at an ever more dizzying pace toward apparent total reliance on technologic man, interest inevitably grows in answers to the question: How has it all come about? Whence has come our technocentric predicament? It is obvious that we are here, but how and why? It is curiously significant that historians are at last seriously taking stock of certain anachronistic elements within their own pursuit. Social and economic history has always sought a prop—if oftentimes a shaky one—in the material factors of history. But even today there is, as yet, no fully professional discipline which can be called "history of technology." When one realizes that, except for sporadic scholarly adventures in narrow byways (as well as misadventures on the textbook level), no competent history of technology has existed in the English language, is it not clear that the present monumental effort is epoch-making? In this sense, the present undertaking appears to be a sort of belated historian's anabasis into the obvious. Let us hope that it will spur on still others, especially here in America, to develop the history of technology with a degree of energy comparable to that now expended on other historical disciplines.

Volume I of *A History of Technology* [*Science* **121**, 549 (1955)] related a history of the period from earliest antiquity through the fall of the pre-Greek "Ancient Empires." This history, of necessity, relied almost exclusively on evidence unearthed by archeologic excavation. This of course is the result, in part, of the fact that many pre-Greek literatures are lost and hence unknown to us. In addition, perhaps because of the randomness of archeologic finds, what fragments we do possess from such literatures are mainly nontechnical. Hence, artifacts provide the soundest clues about the nature and sources of the substances employed in pre-Greek technology, and tools, especially, point to the techniques themselves.

The present volume deals with classical and postclassical civilizations of the Mediterranean and of areas to the north, through approximately 22 centuries. Although archeology remains vital for an understanding of this period, literary evidence constantly increases until, by the end of the 15th century, the historian's problem is decidedly one of selecting representative documents from a vast array of possibilities. The editors carefully point out that the problem of selection will become increasingly acute as the project moves nearer to our own times. The tempo must increase. If volume I registers *andante,* then volume II is a movement in *andantino.* Inevitably, succeeding volumes will reach *allegretto* and *allegro.*

It is impossible, in such a brief review, to do more than outline the contents of 800 pages of detailed history. The general plan of volume I has been only slightly modified in volume II. After a brief but useful set of "Historical notes," by A. R. Hall, there are five basic subdivisions, which divide the concept of technology as logically as it can be done.

Part 1 concerns "Primary production," by which is implied the production of the most basic raw materials. The late C. N. Bromehead contributed an analysis and description of "Mining and quarrying to the seventeenth century." This is followed by an excellent history of "Metallurgy," by R. J. Forbes, undoubtedly the leading expert in this field and period. Finally, E. M. Jope has written on "Agricultural implements," which, as part of the broader history of agriculture, complements other chapters in both volumes I and II.

Part 2 treats of "Manufacture." Forbes has contributed a chapter on "Food and drink." John W. Waterer writes on "Leather," to which is appended "A note on parchment," by H. Saxl. "Spinning and weaving" is treated by R. Patterson. Description of the manufacture of furniture and ceramics is subdivided by periods: Cyril Aldred writes on "Furniture: to the end of the Roman Empire," and R. W. Symonds discusses "Furniture: post-Roman." Gisela M. A. Richter analyzes ceramics in the earlier period, and Jope contributes the articles on medieval ceramics. "Glass and glazes" are described by D. B. Harden. The late F. Sherwood Taylor, well known historian of science, and Charles Singer have written an extremely valuable history of "Prescientific industrial chemistry," in which they complete the account of what is known of both high- and low-temperature processes and cover phases not specifically treated in other chapters. To this chapter is appended "A note on military pyrotechnics," by Hall, which I found awesome and intriguing. In addition to such well known combustible products as naptha, bitumen, resins, and later, gunpowder, Hall discusses the infamous, secret "Greek fire" in detail. It was undoubtedly because of the use of "Greek fire" that the Byzantine Empire, for example, successfully withstood the Muslim attacks of the 7th century and later.

Part 3 concerns "Material civilization," and includes "The medieval artisan," by R. H. G. Thompson, "Building construction," by Martin S. Briggs, and "Fine metal-work," by Herbert Maryon. To the latter is added "A note on stamping of coins and other objects," by Philip Grierson.

In part 4, devoted to "Transport," R. G. Goodchild and Forbes discuss "Roads and land travel, with a section on harbours, docks, and lighthouses" in masterly fashion. All that is known to date concerning, for example, the famous Roman roads and the lighthouse at Alexandria—one of the wonders of the ancient world—is beautifully summarized, with a detailed bibliography which will lead the interested reader to scholarly literature dealing with special problems. In this same section, "Vehicles and harness" are described by Jope, and "Shipbuilding" is described by T. C. Lethbridge.

The final part 5 deals with "Practical mechanics and chemistry." Forbes again contributes a chapter, on "Power," and there is an appended "Note on windmills," by Rex Wailes. It may surprise some readers to find that the earliest authentic mention of a windmill in the Western world dates from no earlier than circa 1180. This is followed by an excellent chapter on "Machines," by Bertrand Gille. To this is added "A note on ancient cranes," by the famous historian of technology, A. G. Drachmann. It is followed by three chapters: "Hydraulic engineering and sanitation," by Forbes; "Military technology," by Hall, and "Alchemical equipment," by E. J. Holmyard.

After all these solid contributions, to which I cannot do justice here, we find an "Epilogue: East and West in retrospect," by Charles Singer. Since, from the earliest planning stages, the editors understandably found it impossible to bring, within the compass of five volumes, a history of *world* technology that would be both responsible and comprehensive, the decision was forced on them to restrict their history almost exclusively to what we know as Western civilization. Yet they are well aware of the fact that the West did not live in technologic isolation. Indeed, Singer finds that, during the span of the last millennium covered in the present volume, "technologically, the west had little to bring to the east. The technological movement was in the other direction. Not seldom, and especially under stress of persecution and war, there were emigrations of eastern craftsmen to the west. These taught their methods to European pupils and apprentices, and so added the technical traditions of their own lands to those already being practiced in Latin Christendom. . . . Thus from Persia and China, and to some extent from India, materials, wares, techniques, and ideas filtered through the main approaches to the west" (pp. 757–758).

The epilogue is therefore designed to suggest adjustments in our historical perspective, and the design is admirably carried out. If one studies carefully only two pages (770–771), which consist of a chart that shows the "Transmission of certain techniques from China to the West," one cannot help but realize the magnitude of our often forgotten technologic debt to the Far East.

The only misprints I have noted are few and innocuous, an indication of the great care and accuracy everywhere visible in this work. They do not even bear listing here, for if the reader finds them he will correct them more easily himself. The book is well printed, and the plates are excellently reproduced, as is usual with books from the Oxford press. There are some 700 figures in the text, all clear and well detailed. Three indexes, of personal names, place names, and subjects, make the volume as a whole easy to consult. In addition, each article is followed by a list of exact references and usually by a separate general bibliography which covers that particular topic. Finally, it might be mentioned that volume II has been considerably lightened, in comparison with volume I, by the sensible use of thinner, yet amply strong, paper within the same format. This is still far from a pocket book, and for this we are also glad, but it is at least easier to handle than is its somewhat bulky predecessor.

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History of Analytic Geometry. Carl B. Boyer. Scripta Mathematica, Yeshiva University, New York, 1956. 291 pp. Illus. $6.

The greater part of the *History of Analytic Geometry* was first published as a series of articles in *Scripta Mathematica,* volumes 16 through 21 (1950–55). It is gratifying that the complete book, in final form, has now appeared.

The first four chapters cover the period prior to the beginning of the 17th century and give the history of the ideas which precede the invention of analytic geometry proper. Although coordinates in the plane or on the sphere were already used in ancient times, in particular by Greek mathematicians in connection with their very elaborate theory of conic sections (founded by Menaechmus and systematically completed by Apollonius) or with their astronomy, the Greek mathematicians did not develop an algebraic geometry in our sense. Probably one of the chief reasons is the fact that their algebra had a geometric form. The introduction of a literal symbolism into algebra during the 16th century—in particular the work of the French mathematician Viète—was an important preparation for analytic geometry.

The central chapter V of the present book is devoted to the two great French mathematicians Fermat and Descartes, who, in the first part of the 17th century, almost simultaneously, but independently, founded analytic geometry. Although Descartes' book *La Géométrie* was published in 1637, Fermat's short but systematic treatise *Ad Locos Planos et Solidos Isagoge* and his other contri-