Book Reviews

The Anthropology of Mathematics

Evolution of Mathematical Concepts. An Elementary Study. RAYMOND L. WILDER. Wiley, New York, 1968. xx + 234 pp., illus. $8.

A mathematician all too frequently is regarded by the man in the street as one who has exceptional number facility—a counter-caster, as Shakespeare has Iago meanly call Cassio. Psychology has shown, however, that mathematical ability has more subtle and more elusive facets; and Jacques Hadamard in 1949 sought to identify, in *The Psychology of Invention in the Mathematical Field*, the factors at work in the creative process. The volume under review deals with a complementary aspect of the problem, one which might be described as the anthropology of invention in the mathematical field, for it concerns chiefly "the evolution of mathematics as a cultural organism." Forces operating on an individual are not generally discussed, for serendipity, while also important, belongs more properly to psychological studies. Unlike the efforts of the individual, the author argues, cultural change, such as that which mathematics is undergoing at the present time, may gain such impetus that it cannot be diverted from its course. The book is motivated by "the desire to determine, if possible, how and why mathematical concepts, such as *number* and *geometry*, were created and developed"; and despite the eminence of the author in mathematical research, the material is presented from "the standpoint of an anthropologist, rather than that of a mathematician." Appropriately, the only portrait in the volume is a frontispiece likeness of E. B. Tyler, the English anthropologist.

Attempts to account for the development of mathematics are not exactly new, for Herodotus in the 5th century B.C. attributed the origin of geometry to the practical need in Egypt for redrawing boundaries following each annual flooding of the Nile. Wilder avails himself of the tools of modern social science to probe with more sophistication into the interactions of mathematicians with the society in which they operate and into the internal pressures within the subject itself; but here too one suspects occasionally a modicum of oversimplification. Citing with approval the thesis of L. A. White that the use of symbols distinguishes man from other animals, he tells us that "It is *symbolization* that not only makes cultures possible, but furnishes the means for their continuity and growth," and that "Counting is, then, a *symbolic process* employed only by man, the sole symbol-creating animal." Modern mathematics does confirm the importance of good notations, but haunting suspicion that the role of symbolism may have been hyperbolized rises when one recalls the glorious nonsymbolic achievements of Greek geometry, the Arabic development of a rhetorical algebra, and evidence that animals do indeed count. Again the facile suggestion that the decline in Hellenistic mathematics may have been due to failure to advance in symbolism begs a counter suggestion that perhaps this same "failure" could account also for the earlier rapid rise in Hellenic mathematics.

The author describes his volume as a book *about* mathematics, rather than a contribution *to* the subject; and in order to avoid technicalities he has focused attention on two elementary aspects, the concept of number and the role of geometry. Almost a full chapter is devoted to the clarification of the idea of a real number, but the cultural foundations of negative and imaginary numbers are barely touched upon. The evolution of geometry receives less ample treatment than that of number; and one regrets that, perhaps influenced by the level of the exposition, the author did not apply his principle of internal (hereditary) and external (environmental) stresses to the problem of why mathematics in the 17th century exhibited so inhospitable an attitude toward projective geometry. Incidentally, the suggestion that the solution of the problem of the parallel postulate in geometry was the result of insight gained through the formal character of axiomatic systems in algebra appears parlous, in view of the fact that non-Euclidean geometry appeared in Germany, Russia, and Hungary *before* postulational algebra arose in England.

Wilder's book is not intended to be a definitive treatment of its subject—to determine how and why mathematical concepts were created and developed—for it represents something of a pioneering effort in this direction. Few readers will accept every statement as firmly established; but fewer still will fail to enjoy the novel approaches, the suggestive insights, and the penetrating views concerning the forces which have brought mathematics into being. The author writes with exceptional clarity, with wide historical acquaintance, with thorough mastery of the mathematical material, and in an attractive style. His keen perception and judgment in emphasizing what is important makes the book particularly rewarding reading, and additional pleasure is afforded in that proofreading has come as close to perfection as is humanly possible. For those who insist on a happy ending, the book closes on an optimistic note: "The present-day situation in mathematics is made all the more interesting by the realization that there cannot, because of the cultural nature of mathematics, ever be an end to its evolution."

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Renaissance Essays

Reflections on Men and Ideas. GIORGIO DE SANTILLANA. M.I.T. Press, Cambridge, Mass., 1968. xiv + 381 pp., illus. $15.

In this handsome book, Giorgio de Santillana has brought together the scattered articles and occasional papers he has published during the past quarter century. Santillana is perhaps best known for his *Crime of Galileo*; these assembled pieces disclose the range of his interests and—as Hugh Trevor-Roper admiringly says in his foreword to the book—the extraordinary range of