Book Reviews

On the Unity of Time

Time has long been recognized as one of the most fundamental concerns of man. It is not surprising then to see important research develop around the subjects of time in history, time in psychology, time in biology, and time in physics and cosmology. It is surprising, however, to realize that there has been little interest in supporting research on the general nature of time. Pursuit of the subject has been an individual matter, carried out usually in connection with a specialized interest or a personal point of view.

When J. T. Fraser became interested in the meaning of time after World War II, he recognized the need for creating a new discipline around the idea of time. He managed to get support for such a project and organized conferences to establish cooperation between specialists working on problems of time in various fields. The tangible result is this collection of essays by 26 distinguished authors—**The Voices of Time: A Cooperative Survey of Man's Views of Time as Expressed by the Sciences and by the Humanities** (Braziller, New York, 1966. 736 pp., $12.50), edited by Fraser.

The stated purpose of the volume, to offer material and encourage the search for new knowledge related to time, promises to be fulfilled. Considered individually, the essays are excellent, but they will offer few surprises to the peer group of each specialist. However, bringing the research results, the insights, and the speculations from so many fields of activity into juxtaposition has a stimulating and illuminating effect.

Fraser believes that the theme of time can serve as a common ground for closer communication between the sciences and the humanities. The confrontation of views presented by humanists and scientists in the body of the work illustrates such a possibility, but the synthesis attempted in the sections written by Fraser, who has been trained primarily in science, points to certain dangers. His humanistic sympathies are largely sentimentalities, and his generalizations in the areas of the humanities are all too often simplistic. In America one of the characteristics of attempts to bridge the gap between the "two cultures" is to find a mechanism, a method with a key or a gadget, to achieve instant results. There can be no substitute for depth studies in both areas, and if this cannot be achieved by a single individual, discourse between specialists is preferable to superficial syntheses.

The basic assumption underlying this volume, Fraser asserts, is the idea of the *unity of time*. "When specialists speak of time, they speak of various aspects of the same entity." The search for this entity was undoubtedly the motivating force that brought this volume into existence, but the failure to find the unity of time is indicated by the use of "voices" rather than "voice" in the title. In fact, in some of the essays doubts are raised about the existence of an "entity" of time. When used as an entity or force in the universe, time may very well prove to be a reified concept. Moving from discipline to discipline, the conviction grows that the actual use of the idea of time is to express a function or measurement of the processes under study, even though the writer may believe in the existence of an entity of time. However, even if the idea of time is an operational concept rather than a real structure in the universe, it is still a meaningful focus for research. In fact, a part of that research should be ascertaining whether it makes any difference to believe in the unity of time.

The Voices of Time contains four parts that represent major areas of subject matter. The first part, "Time in Thought," includes essays on the historical and cultural diversity of ideas about time. In an essay on ideas of time in the history of philosophy, A. Cornelius Benjamin shows how representative philosophers from Heraclitus to Samuel Alexander have tried to resolve the paradoxes stemming from the idea of time. Friedrich Kümmel concentrates on lived time, the problem of duration and the paradoxes in understanding "past, present, and future." A compact history of time in Christian thought from the Greek influence to Teilhard de Chardin is given by J. L. Russell; Hajime Nakamura presents a comparison of notions of time in Indian and Japanese thought, and Joseph Needham presents a detailed analysis of Chinese ideas of time and then compares them with Western views. He also relates attitudes of time in China and the West to the problem of scientific development. S. G. F. Brandon surveys ideas of time in connection with man's awareness of having a destiny and the reactions of man to the challenge of death, and he points to the dilemma of modern man whose scientific world picture leaves little ground for the hope of transcending death.

Communications, rhythm, and behavior in the life of man are the theme of part 2, "Time and Man." The function and expression of time in language and literature is analyzed by C. F. P. Stutterheim, and the role of the temporal structure in the rhythmic forms of music is examined by Walther Dürr. The experimental findings in time perceptions and temporal expressions of children is presented by Jean Piaget. The work of Jung on synchronicity and its implications for analytic psychiatry are brought out by M. L. von Franz, and Joost A. M. Meerloo discusses the time sense in psychiatry. John Cohen's essay on subjective time raises the problem of a biological time clock in man.

Part 3, "Time and Life," deals with biological time. Karl C. Hamner gives the experimental evidence for the biological clock, and J. L. Cloudsley-Thompson does the same for the time sense of animals. The biochemical basis for time awareness, particularly in connection with change of temperature, is discussed by Hudson Hoagland. Hans Kalmus explores the idea of time in evolution as a stochastic process, and Roland Fischer develops the idea of a biological "equivalence" of space and time.

In part 4, "Time and Matter," a historical sketch on timekeepers by H. Alan Lloyd and a discussion of time measurement for scientific use by G. M. Clemence precede essays that take the reader to the forefront of thinking about time in physics and cosmology. Time in relativity theory is approached from three perspectives. Olivier Costa

de Beauregard argues for a philosophy of being from relativity theory, while Miliĉ Ĉapek counters with an argument for a philosophy of becoming. The controversy centers around the problem of whether or not there is a process of becoming in the physical world which runs parallel to our experience. Ĉapek argues that there is an objective succession of moments in the objective world corresponding to the transient character of our mental present. Costa de Beauregard argues for covariance. Approaching the problem from still another perspective, Herbert Dingle explores the question of whether time in relativity theory is a measurement or a coordinate of the universe. His conclusion is "that the physical phenomena which have led to the theory of relativity have no contribution to make to the solution of problems concerned with time." The reason for his conclusion is based on the proposition that relativity theory is concerned only with "time at a distance" and all metaphysical and psychological problems of time *here* are irrelevant to the theory of relativity.

There are also essays in this part on time and quantum theory (E. J. Zimmerman), time and thermodynamics (Richard Schlegel), time and the probabilistic view of the world (Satosi Watanabe), and time and the universe (G. J. Whitrow), and a summary essay on the study of time by the editor.

One of the most important characteristics of these essays is that their authors have written them around challenging and suggestive interpretations. They have made no concessions to popularization, but neither have they indulged in obscurity or ambiguity. The editor could have made additional choices for inclusion, but the selections he did make are excellent, and he deserves the highest praise for bringing together in a single volume such a cluster of distinguished scholarship.

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European Prehistory

It has long been customary for archeologists to consider man's prehistoric past in terms of stages of technological development: our traditional reference scheme of the three consecutive ages of Stone, Bronze, and Iron dates to the publication (1836) of C. J. Thomsen's classification of the archeological collections in what is now the National Museum in Copenhagen. During the past three decades, some archeologists have made conscious efforts to extend the breadth and scope of such a limiting conceptual model of the past. The archeologist, by drawing on techniques primarily scientific in character, can now incorporate in his interpretation data concerning changes in particular aspects of the natural environment and in the economic activities of extinct, nonliterate societies. The resultant technological-economic interpretive schemes are, manifestly, essentially interdisciplinary—ideally, "scientific archeology" is a bridge between C. P. Snow's Two Cultures.

Professor Stuart Piggott's **Ancient Europe, A Survey** (Aldine, Chicago, 1966. 367 pp., $7.50) embraces the up-to-date "scientific" archeologist's interest in man's mastery over particular environments and various technical problems. But as Piggott demonstrates most admirably, the writing of prehistory involves far more than the description and classification of economic activities, artifacts, and cultures. Essentially, prehistory is a part of history. It is a matter of an individual prehistorian's interpretation of man's achievement in his past. In this the prehistorian, like the historian, will be influenced by the standards of his age. Piggott's private view is a particularly timely one: the omnipresent conflict between innovators and conservators, between developed and underdeveloped peoples.

This survey begins with the spread of the first agricultural communities from the Aegean to the Baltic and Atlantic seaboards in the period 6000 to 2500 B.C. As innovations transmitted by movements of peoples and by assimilation, the arts of animal domestication and cereal cultivation, and the custom of living in permanent or semi-permanent villages, contrast strongly with the primary Paleolithic-Mesolithic traditions of the indigenous hunter-fishers. The consequent development of this basic stratum of stone-using farmers is disrupted by pastoralist immigrants from the Russian steppeland, who may have been associated with the dispersal of the Indo-European languages, and who seem to have provided a dominant element in the society that was to follow.

With the development of copper and soon bronze technology, Piggott traces the establishment of patterns of trade relations and the first stammering beginnings of an armaments race. Increase in trade, carrying with it a growing awareness, in a now predominantly Celtic Central Europe, of the rich civilizations of the Aegean and Orient, and increasing technological development and improvements in the art of war lead to a buildup of the European economic position, and, ultimately, to the collapse of the Mycenaean world. Subsequent shifts in the balance of power and movements of peoples all over mainland Europe, together with the acquisition of techniques of working iron, form the background to the final confrontation: that of the Roman and the Barbarian documented in classical sources.

Piggott's enquiry into the ancient origins of historical Europe is original, closely argued, and fascinating. Although Piggott disarmingly claims that his book is one man's view of European prehistory, this landmark in archeological writing will gain many converts among layman and specialist alike.

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Biochemistry

The new, completely revised and reset third edition of Lester Smith's monograph **Vitamin B_{12}** (Methuen, London; Wiley, New York, ed. 3, 1965. 192 pp., $4.25) demonstrates the considerable progress in the chemistry and biochemistry of vitamin B_{12} made during a 5-year period as a result of the discovery of the vitamin B_{12}-coenzymes in 1958. In a style that is admirably compact but nevertheless readable the author describes the frontiers of research and considers the literature up to 1963. Several chapters cover, sometimes in detail, the origin, distribution, isolation, chemistry, and nomenclature of vitamin B_{12} and vitamin B_{12}-coenzyme, as well as their derivatives and analogues including the vitamin B_{12} antagonists. Probably because of limited space the biological and medical aspects of vitamin B_{12} and intrinsic factor are only described as a selected treatise. The short chapters on the assay and mechanism of action of vitamin B_{12}, vitamin B_{12}-coenzyme and intrinsic factor, vitamin B_{12}-binding factors, the metabolism of vitamin B_{12} in mammalians and man, and the diagnosis and therapy of vitamin B_{12} deficiency and nutritional aspects do not