

Book Reviews

Space, Technology, and Society: From Puff-Puff to Whoosh

This delightful spin-off from the moon-doggle is a wonderful illustration of the principle that excuses are always more important than reasons, and that even the flimsiest of excuses can produce results which the best of reasons cannot supply. The excuse for this volume, **The Railroad and the Space Program: An Exploration in Historical Analogy** (M.I.T. Press, Cambridge, Mass., 1965. 245 pp., \$7.50), edited by Bruce Mazlish, was an invitation from the National Aeronautics and Space Administration to the American Academy of Arts and Sciences to make a study of the effects of space activity on our society. As these effects are still largely in the future, the first impulse of the study turned towards the past, and this volume, as its subtitle indicates, is an attempt to use historical analogy to uncover certain patterns in social systems which might be repeated in the present and future. There is a brilliant, if somewhat long-winded, defense of this procedure by the editor, which constitutes the first essay in the volume; then there is a series of seven essays by different authors on various aspects of the impact of the railway on the United States in the 19th century. Each essay concludes with some remarks on the application of the principles discovered to the space program, which remind me, I am afraid irresistibly, of the libations to Marxism-Leninism which usually accompany quite sensible Russian works. The essays themselves, however, are of uniformly high quality, well written, instructive, and provocative, and any one of them can stand on its own feet without reference to the ostensible excuse for the book. However, the excuses, that is, the references to the space program, are also quite entertaining, are certainly not expected to be definitive, and form, as it were, a pleasantly decorative icing on the good cake of scholarship.

In the first of the seven essays, Thomas P. Hughes discusses the railroad as a technological frontier, and makes the railroad almost look like a

mere transitional stage between the canal and the subway. However, the impact of the railroad engineer and of the railroad on the development of engineering schools is duly noted, and although the contribution of the railroad to overall technological development is probably more modest than popular imagination perceives, it is nevertheless noticeable.

The next two essays, by Robert W. Fogel and Paul H. Cootner, are on the economic aspects of the railroad. Both essays summarize larger works, and they represent a rather fundamental reevaluation of the impact of the railroad on American development, which represents almost an anti-railroad school of thought. Fogel, in a remarkable statistical tour de force, has made a rough calculation of the total impact of the railroad on American development in quantitative terms, and finds it surprisingly small. We could, apparently, have gotten along without it, with canals and roads. A possible weakness of this analysis is that it is concentrated very heavily on the transport of goods, somewhat to the neglect of the impact on passenger transportation. Nevertheless, the main points are made cogently, and I must confess that my own image of American history was substantially revised as a result.

In the next essay, Alfred D. Chandler, Jr., and Stephen Salisbury discuss the impact of the railroads on business administration and organization. It is at this point, perhaps, that the impact was greatest. Railroads, the first of the big businesses, developed an interesting variety of styles in organization, and their experience undoubtedly carried over later into the organization of the great corporations. The struggle between centralization and decentralization on the railroads foreshadows similar struggles in General Electric, the Soviet Union, and other large economic organizations.

The next essay, by Thomas C. Cochran, studies the social impact. This is somewhat more of a "think piece" and

less based on original research than the others, perhaps because the research has simply not been done. Within the limitations of its material, however, it is a charming and insightful essay. The next essay, on the political impact, by Robert L. Brandfon, is a case study of the fight between the State of Mississippi and the Illinois Central. This again is delightfully written and recounts a very entertaining episode in American history. The last essay, by Leo Marx, on the impact of the railroad on American imagination, is the briefest but in many ways the most stimulating. Here again it represents, in a sense, a summary of a much larger work, and the central theme of "the machine in the garden" is vivid and illuminating.

The opening paragraph of the book betrays the origins of the space program in our fear of "the vengeance of history," which is risked, according to Representative George P. Miller, by "whosoever says going to the moon and Mars is a waste of money." The same vengeance is also risked by those who say it is not a waste of money, and it could well be that the space program is a prize example of how history exacts vengeance by being misread. If the impact of a volume of this kind is to give us a few second thoughts about historical parallels, the spin-off will be well spun.

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Palynology

Palynologists have waited a long time for the publication of this text volume, **Pollen and Spore Morphology. Plant Taxonomy—Gymnospermae, Bryophyta**, vol. 3 (Almqvist and Wiksell, Stockholm, 1965. 216 pp.), by Gunnar Erdtman. It is a companion volume to the illustrations (vol. 2) which were published in 1957. Volume 3 is divided into three parts, of which the first provides a very brief account, arranged by families, of megaspore membranes of the Gymnospermae. The next part, alphabetically arranged, *Abies* to *Zamia*, consists of the descriptions of some 64 genera and an uncounted number of species. The third part is devoted to the descriptions of 245 genera and representative species of Bryophyta. This compilation makes available, for the first time in one place, the generic descriptions of

gymnosperm pollen and bryophyte spores. It is well illustrated, with excellent photographs of spores and pollen grains as well as electron micrographs of sections of wall and electron micrographs of the surface texture to show fine details at magnifications between 5000 and 15,000 times. These photographs and the palynograms provided in volume 2 are a good combination in that they supplement each other and give the palynologist a better concept of the structure of the grains so illustrated. There are descriptions of a few genera which were not illustrated. The text for the Pteridophyta illustrations, which has been omitted from this volume, will be the subject of a subsequent volume. The specific descriptions are very brief. An examination of the genus *Pinus* reveals a selection of some 25 species from various countries but not a complete in-

ventory of all pine species. American palynologists will be disappointed to learn that descriptions and measurements of *Pinus strobus*, *P. resinosa*, *P. echinata*, *P. monticola*, and *P. ponderosa* were not included. The rare *Abies fraseri* is included whereas the common *A. balsamea* is omitted. Some of these are so important in the investigations of the peat profiles in North America that their absence is noteworthy. Erdtman is noted for coining new terminology to describe various features of pollen and spore structure. This text contains many terms that were not used in the preceding volumes, and there is no glossary to explain their precise meaning, although they have been included in *Grana Palynologica* and other publications.

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Astronomy and the Smithsonian Institution

The Smithsonian Astrophysical Observatory (SAO), now symbiotically located with the Harvard College Observatory in Cambridge, Massachusetts, recently celebrated its 75th anniversary. **Lighthouse of the Skies: The Smithsonian Astrophysical Observatory, 1846–1955** (Smithsonian Institution, Washington, D.C., 1965. 355 pp., \$5), by Bessie Zaban Jones, is the story of its first 65 years, when SAO was located in Washington, D.C., a period in utter contrast to its last decade during which SAO catapulted into the ranks of the major institutions of astronomical research.

The history of its first 65 years cannot be separated from that of the Smithsonian Institution (SI) itself, as the author fully recognizes. As a result, the book is much more than a history of a modest, almost obscure, government observatory. Its importance lies in the fine illumination and trenchant insight that it gives to the growth of scientific institutions in the past century and in its skillful delineation of the quiet but powerful role that SI played in almost every major field of science. It constitutes a major contribution to the history of American science.

As American observatories go, SAO is not old, but its conception antedates that of SI. Its spiritual founder was John Quincy Adams, who not only valiantly guarded the Smithsonian bequest from Washington predators, but also

urged that the funds be used entirely for an observatory. Two decades before the founding of the Smithsonian Institution (1846) he had, in his first presidential message, recommended a national observatory, and two years before that he had offered Harvard the then-large sum of \$1000 toward an observatory. Neither gestures bore any immediate fruit. It was Adams who called observatories "lighthouses of the sky," a phrase that was politically costly to him. He dedicated his first "lighthouse" in Cincinnati in 1843. The Smithsonian "lighthouse of the sky" had to wait nearly a half century before it came into feeble existence.

When, after much political bickering, the Smithsonian Institution was finally established under its first, and outstanding, secretary, Joseph Henry, the idea of SAO was further formulated, but it was not until the administration of its third secretary, Samuel Pierpont Langley, that the observatory became a humble reality (1890). It was dedicated to the "new" astronomy, the physical study of stars, as the present SAO is dedicated to the study of the "newest" astronomy, space-vehicle astronomy. The Smithsonian Astrophysical Observatory concentrated on one star, the sun, and is most noted for the determination of the solar constant and for early investigation of the solar infrared spectrum.

That SAO was soon outdistanced by

other American observatories lies not so much in the lack of vision or ability of its successive directors, as in the utter niggardliness of the Congress in supporting it. Readers will find that story hard to believe; it is a monument to the purblindness of past Congresses to the potential of science, a monument matched only by the foresight of the Ordnance Department which, as late as 1930, saw "no immediate or near future use" for the Goddard rocket, which was developed under staunch support from Smithsonian.

One must wonder at the dedication of the early leaders of the Smithsonian in accomplishing so much with so little, but one may also wonder if they would not have done better by American science had they spent less time in lengthy, detailed, scholarly, and even literary reports and letters, and more on human and public relations, on learning more about their fellow men—particularly those who happened to be politically influential! Certainly the directors of most American observatories have learned that lesson today.

Lighthouse of the Skies is deftly told in a felicitous style. It is an event when a writer of merit undertakes what might otherwise be a drab task—that of writing the early history of a government observatory. The result is an entertaining work in which scholarship is not sacrificed, a rare combination. The author uses a lively change of pace in her writing, bringing to life incidents that might otherwise have all the glamor of pedantic footnotes.

The book should be required reading for all members of the Smithsonian Institution, not only of its observatory. And when they are inclined to complain, observers at the far flung SAO satellite tracking stations should pay particular attention to the ordeals that early SAO observers at the solar stations underwent. The accounts should cheer them up.

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Physical Models of the Climate

Climatology has undergone a remarkable metamorphosis. Two decades ago it began to emerge from a primarily descriptive stage. In the next decade, statistical analysis led to much progress. During the past 10 years