

parallels with other, older technologies. For instance, similarities and differences between the early history of the automobile and the computer are examined in several papers, most notably in the one by Alphonse Chapanis. Similarly, in a concluding chapter, Raymond S. Nickerson convincingly applies Toynbee's concept of "progressive etherialization" to developments within information technology.

Third, several participants explore the idea that historic ways of viewing science and technology, and the latter's interaction with society and human behavior, are antiquated and ill suited to the newer technologies. In so doing, in their papers they analyze the traditional conventions that have been associated with the older mind-set.

The value of these essays to the historian of technology will depend on his or her ability and willingness to extrapolate from them; the effort will be well worth the time. Fond as many of us are of measuring the impact of a technological artifact by its prevalence in society, the historical importance of the symposium theme can best be summarized by Nickerson's concluding observation that "by the end of this decade the number of electronic circuits available for use in the United States will be roughly two million times the size of the population" (p. 206).

MICHAEL L. BERGER*

Early Thematic Mapping in the History of Cartography. By Arthur H. Robinson. Chicago: University of Chicago Press, 1982. Pp. xiv + 266; illustrations, notes, references, index. \$35.00.

Arthur H. Robinson is one of the most eminent cartographers of our time. His latest book, though not written specifically for an audience of historians of technology, is a provocative work rich in ideas of interest to them, as it displays the interdependence of the thematic map and the culture from which it emerged. Thematic maps show "the difference from place to place of one class of feature, that class being the subject or 'theme' of the map" (p. 16). The selection of a single theme to be mapped creates a visual display in which the spatial distribution of that theme is dominant. Consequently, this sort of map can be a tool quite useful in making quantitative comparisons between regions containing the depicted class of feature. Familiar contemporary examples that might appear alone, or in articles discussing current events, are a map showing the distribution of land in the United States devoted to raising wheat, or a map portraying the distribution of Spanish-speaking residents of the Western Hemisphere.

Robinson traces the evolution of this cartographic tool from its early

*DR. BERGER teaches courses in technology and human behavior at St. Mary's College of Maryland. He is the author of several books, including *The Devil Wagon in God's Country: The Automobile and Social Change in Rural America, 1893-1929*.

appearance around the middle of the 17th century to its emergence in nearly contemporary form by the middle of the 19th century (pp. 18–26). He does it within the larger cultural setting of Northwestern Europe by tying developments in thematic mapping to major technical and scientific trends following the Industrial Revolution and by exhibiting (on one occasion at least) the use of a thematic map to lead scientific development (pp. 176–78; Snow's cholera map of London shows the distribution of cholera victims in relation to the location of water pumps).

The first two chapters place the thematic map in the general cultural and scientific fabric of the history of cartography and are probably of more use to the general reader than to specialists in either geography or history (as was apparently the intention). The third chapter presents a general survey of the development of thematic mapping in the period covered. Much of the content of this survey is expanded on in the three chapters that follow, by focusing first on "Maps of the Physical World," then on "Maps of People and Their Activities," and finally on those "Maps of the Social Environment." The order of these three chapters reflects the chronological order of the appearance of each type of thematic map. A final chapter reviews symbolism, duplication, tone, and other issues pertinent to the technical production of such a map.

Because Robinson limits his study (apparently because of various economic concerns) to Northwestern Europe, transfer of this growing technology to other locales is not addressed. However, problems of interest to historians of technology, such as Thomas P. Hughes's view of "momentum" of technology, would emerge quite clearly, I think, if the interdependence between the mapping of a theme and the choice of underlying map projection were focused on. For this natural association provides a mathematical stimulus, internal to the mapping process itself, to such "momentum." Robinson touches on this, but only briefly. He does comment on the appropriateness of employing a conformal projection (one in which angle is preserved) for displaying a theme based on angle measure (p. 69) but follows this up with only very indirect mention (p. 105: "these maps . . . do not portray distribution very effectively") of the appropriateness of using an equal area projection to display an areal phenomenon such as the distribution of botanical plants. In the same way, he might have extended (but did not) his observations on Minard's practical strategy of sliding England out of position to suit specified quantitative symbolism needs (p. 157), which foreshadows the cartogram, a 20th-century creation often used in the manner of Minard to represent issues of a single theme in such a way that quantitative comparison is easy.

In general this is a very attractive book, filled with handsome photographs of maps with a wide variety of themes, from Halley's ingenious solar eclipse map tracing the shadow across England in 1715 to Minard's map of the volume of French wines exported by sea in 1864. All are reproduced clearly on glossy paper of high quality; many are in

color. The selection of maps used to complement the text is interesting, and text and maps are generally woven skillfully into a unit in which the presence of one enhances the other.

SANDRA ARLINGHAUS*

Iron and Steel on the European Market in the 17th Century: A Contemporary Account of Production Forms and Marketing. Edited by the Historical Metallurgy Group of the Swedish Ironmasters' Association. Translated by Gunnar Pipping and Geoffrey French. Stockholm: Historical Metallurgy Group of the Swedish Ironmasters' Association, 1982. Pp. 271; illustrations, notes, glossary, bibliography, index. Skr 110:00 (cloth); Skr 90:00 (paper). Available from Jernkontoret, Box 1721, S-11187 Stockholm, Sweden.

The publication of this volume should be welcomed by all serious scholars with an interest in the iron and steel industry before the Industrial Revolution. Economic historians and historians of technology both can profit from the book, which makes available a remarkable 17th-century manuscript recently discovered in the Norwegian National Archives. In addition to the text of the manuscript, published both in the original German and in English translation, the book contains a brief summary of the manuscript, a short discussion of the economic background, and a somewhat fuller commentary ("Technology, Production, Costs") on the contents of the manuscript.

The manuscript is believed to have been written by Abraham Cronström, a member of a prominent Dutch-Swedish family that was deeply engaged in the Swedish iron and steel industry. During the 1660s, Cronström made a series of visits to various European centers of iron production. The manuscript, which presumably represents the fruits of these travels together with his extensive experience within the Swedish industry, contains detailed information on the technology of the 1660s in Sweden, northern Spain, Liège, the Harz mountains, Lorraine, Westphalia, and even England. The author dealt with the production of charcoal, pig iron, wrought iron, and steel; data are presented on technology, production costs, qualities, markets, and prices. In short, here is a gold (or iron?) mine of information. What makes it especially valuable is that it refers to a period at least several decades earlier than the periods covered by other studies of the early

*DR. ARLINGHAUS is director of the Colloquium in Mathematical Geography in the Program in Geography at the University of Michigan at Ann Arbor. Her current interests include the mapping of transport and communications systems, from pneumatic postal networks of the early 20th century to contemporary satellite navigation systems.