Lars Heide. *Punched-Card Systems and the Early Information Explosion, 1880–1945.* Baltimore: Johns Hopkins University Press, 2009. 369 pp. $65.00 (cloth), ISBN 978-0-8018-9143-4.

The Evolution of Punched-Card Systems

From their first major use in tabulating the 1890 United States census to the breakthrough of digital computers and magnetic storage in the 1970s, punched cards were the dominant technology for processing the vast amounts of information needed by large, complex enterprises and the modern social state. Indeed, without this information processing capability, the modern world would have looked quite different, and certainly less modern.

Heide's prodigiously-researched book provides a comparative study of the development of punched-card technology and its application in the United States, England, France and Germany from the 1880s to the end of World War II. His point of departure is a dissatisfaction or discomfort with works in the sociology of technology that focus primarily on the social impact of technology, while treating its development as an external factor. Instead, Heide's aim here is to develop an excentric or peripheral account that will explain the trajectory of technological development–i.e. the decision to pursue or neglect a technically feasible path of innovation–not in terms of a company's ability to develop and market a given technology, but rather as an attempt to meet the demands of its real or imagined users and uses. To demonstrate the fruitfulness of this approach, Heide follows the development of punched-card technology through four successive moments of provisional path stability, or technological "closure," relating to its use for, first, the compilation of counting-based census statistics; second, the processing of general statistics; third, bookkeeping; and

fourth, the operation of large population registries.

The bulk of the book is devoted to documenting at each point along the way and in the different national contexts the wide variety of user-related factors that shaped the development of these applications. Such factors included: the obstacles presented by prior commitment to an alternate path of technological development; conditions of access to patented technologies; the intrinsic complexity of punched-card technologies, the ability to accumulate relevant expertise, the ability to leverage knowledge in related manufacturing fields, and associated difficulties in manufacture and operational reliability; the degree to which the acceptance of one technology was dependent on the development of ancillary technologies (such as the ability to print the results of calculations or to store and operate with intermediate sums); success in exploiting prime mover advantages (or the failure to do so); the ability to raise sufficient operating capital and effectively manage it; the development of business or social processes of such scale and complexity that they could no longer be adequately controlled through the use of manual methods of data management; the willingness of potential public- and private-sector users to invest in new data-processing technologies that could only be profitably employed on a continuous basis; and the adoption of punched-card technology by a user influential enough to serve as a model for other potential users. But while these factors may cumulatively shed a great deal of light on the theoretical question that Heide set for himself, it is less clear that potential readers will

share this particular set of concerns. Heide's decision to bracket the question of how this new technology affected the organization and strategic functioning of firms and states or the meaning of the information explosion that appears in the book's title will limit the appeal of the book.

The one point where Heide looks beyond the dynamics of technological change is his discussion of the use of punched cards to maintain large population registries that enhanced the ability of nation-states to locate and control their individual inhabitants. Technologically, the card systems developed for the American Social Security system, the French national population and military mobilization registry, and the belated efforts of the Nazis to develop an automated registry to facilitate the mobilization of the population and the identification and exclusion of community aliens all required new punched-card technologies that were different and more powerful than those developed for existing bookkeeping systems. In the long-simmering debate over the role of census data, population registries, the _Volks-_ and _Judenkarteien_, and punched-card systems in the perpetration of the Holocaust, Heide stakes out a rather moderate position. Here he argues, echoing claims made by others, that the information contained in the nationwide network of locally-maintained manual population registries set up on the basis of the 1938 Reichsmeldeordnung was, in conjunction with other information available to the police and security agencies, more than adequate to seek out Jews for deportation even in the absence of an automated national registry whose development was, in any case, blocked by the resistance of the Gauleiter and other officials to the further centralization of power in the hands of Albert Speer. It was not until well after World War II that computers finally made possible the creation of up-to-date, automated national population registries–and that the real debate on their dangers began.

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