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Alfred D. Jr.. Chandler, James W. Cortada, eds. *A Nation Transformed by Information: How Information Has Shaped the United States From Colonial Times to the Present.* New York: Oxford University Press, 2000. 404 pp. $39.95 (cloth), ISBN 978-0-19-512701-0.

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Chandler and Cortada have produced an edited book that provides a useful historical perspective. Their book contains a preface (three pages), a note on contributors (two pages), nine chapters (297 pages), notes (44 pages), a bibliographic essay (17 pages), an index (18 pages), pictures, graphs, charts, and illustrations. The bibliographic essay contains eight sections, one for each chapter (except Chapter One). This essay might best be read in whole, after reading Chapter One, or in parts, each section being read either before or after the chapter to which it is relevant. Except for Chapters One and Nine, the chapters are roughly in chronological order. Chapter One provides an overview of the historical period under consideration and draws upon Chapters Two through Eight. The book has a few typographical errors.

In Chapter One, Chandler writes the purpose of the book is to: "(1) review the changing technological underpinnings – or, to use a modern term, infrastructure – of the means of transmitting information, (2) consider the changing nature of the recipients of the information flows, and (3) analyze the ways in which the recipients used these flows to shape and reshape U.S. business, society, and culture" (p. 4). Using these purposes as criteria to judge the book, *A Nation Transformed by Information* has two strengths and one weakness. The first strength is that the book helps the reader understand what must be considered to adequately explain the "how" (how information has shaped the United States). Its second strength is the historical perspective it provides. The book's weakness is that it does not provide a comprehensive explanation of that "how." The remainder of this review will address the strengths, and weakness, of the book.

Information does not exist in idyllic and splendid isolation.[1] Information is conveyed by social means to serve purposeful ends. Chandler and Cortada's book helps us recognize that there is a complex and dynamic interrelationship between the means of acquiring and disseminating information, the uses of information, and the information itself. My efforts to grapple with the nature of this interrelationship lead me to suggest a conceptual framework that draws upon the topics covered in Chandler and Cortada's book and can be seen as an elaboration or reformulation of the book's three purposes (cited above). We can think of the interrelationship as having three major components. The first is the information itself, the second is the information infrastructure. (Chandler and Cortada may disagree with my conceptual framework, since they state that "information has been and remains an almost invisible part of the economic infrastructure of the nation..." [p. 298].) Actions of individuals, groups, institutions, and organizations both shape and are shaped by the interrelationship of these two components, and this third component, which I will label (inter-)action, can be considered separately.

The information infrastructure would include at least three major elements. One (not necessarily the most important) would be technology. This would include hardware (such as roads–automotive and rail–computers, telephone lines, cell phones, satellites, and so forth); software (computer programs); and ergware. A second would be the social infrastructure. This would include such things as social mores influenced by ideologies (political and economic), culture, past experience, and spatial relations such as primacy of cities.[2] The second component is intimately related to the third component: the political infrastructure. The political infrastructure would include (at least for the U.S.) the Constitution, laws, regulations, court decisions, and such. A comprehensive explanation of how the nation was "transformed by information" would, therefore, need to explain the dynamic relations between the three main components: information, information infrastructure, and (inter-)action.

For example, in Chapter Two, Richard D. Brown's discussion of the historical and political background, the technology, and the geo-political setting of the pre-

Revolutionary and post-Revolutionary period help substantiate his claim that the foundation of the U.S.'s Information Age was in its early history. The colonies went from a time when the government tried to control the presses to a time when the First Amendment protected the presses. During the colonial period more pages were imported than printed 'at home.' In the colonies, "Grammar schools and academies sought to educate the few who aspired to gentry status and to attend college.... When colonies sponsored colleges, ... the purpose was to supply a locally trained leadership cadre, not to discover or disseminate information more broadly" (p. 41). Still, literacy was important, even if it was to serve religious purposes. The purpose of education began to change in 1776, led by Massachusetts's "provincial congress..." (p. 47). Brown claims that "the American response to *Common Sense* was the single most important manifestation of the communication revolution of late eighteenth-century America. Before 1776 was over, Thomas Paine's pamphlet was published in nineteenth [sic] American editions and received a circulation exceeding 100,000 copies in a country that possessed no more than 500,000 households" (pp. 45-46). Creating an informed citizenry became an important value during this period. Finally, the fledgling nation had from the very beginning a communications system more akin to a network than a hierarchy.[3] Had all of the book's chapters provided the same scope of analysis for different time periods as found in Chapter Two, the book certainly would have come closer to meeting the promise implied by its title and identified purposes.

Chapter Three, by Richard John, also covers aspects of the three components: information, information infrastructure, and (inter-)action. John pushes the historical discussion past the establishment of the new nation, from 1787 to 1914. This period saw "an unprecedented expansion in printing and publishing, the emergence of information-intensive industries such as credit reporting and life insurance, and the elaborations of major innovations in science, technology, and education" (p. 55). John writes of two communications revolutions during this time. "The first communications revolutionˆÅ began in the 1760sˆÅ and culminated in the 1820s with the establishment of a national postal network. The second began in the 1840s, with the expansion of the railroad and the commercialization of the telegraph, and culminated in the 1910s with the completion of a national telephone grid" (pp. 55-56). The young country subsidized the mail by building post offices (75 offices in 1790, 903 in 1800, 2,300 in 1810, 4,500 in 1820, 8,450 in 1830, and 13,468 in 1840); giving newspapers favorable mailing rates; and later reducing the rate for personal letters.

Chapter Three also addresses the relation between the telegraph and the postal service and between the postal service and the railroad. John gives a fair amount of attention to Theodore Vail. Vail was the first supervisor of the Post Office's Fast Mail, "a special high-speed train, staffed by railway mail clerks, that ran day and night between New York and ChicagoˆÅ" (p. 72). (Also see Chandler and Cortada's discussion of Vail in Chapter Nine.) The rise of the telegraph, the telephone, and the beginnings of radio, as well as the response of the federal government and the states, helped add to the technical, social, and political infrastructures on which the Information Age has been built.

The seventy-year time period (ending in 1950) covered by JoAnn Yates, the author of Chapter Four, overlaps the time period covered in Chapter Three. Because of this chapter's narrower focus ("business use of information and technology during the industrial age") it does not provide the same scope of analysis as Chapters Two and Three (see for example what endnote 28 says about the chapter). However, within its narrower focus it does cover aspects of the three components previously described: information, information infrastructure, and (inter-)action. In the early history of the U.S. manufacturing industry, most firms "were quite small" and that meant that "owners and skilled artisans could generally coordinate and manage activities through informal oral exchanges" (p. 108). As firms became larger, different "managerial methods" were employed (p. 109). Information went up and down the organizational hierarchy, but there was also "horizontal flows of interdepartmental correspondence..." (p. 112). According to Yates, "The increased appetite for information also contributed to rapid growth in the number of clerical workers to handle it," the numbers increasing by 3700% between 1870 and 1921 (p. 112). The time clock, the cash register, the adaptation of carbon paper, the invention of vertical filing, and the rise in the use of forms all helped standardize the activities of the organization and helped organize information. But once vertical files were adopted, there was a "proliferation of decentralized, departmentally, and individually maintained files..." (p. 118). (How changes in technology facilitated–and required–organizational change is taken up by Richard Nolan in Chapter Seven.) Increased demands for information came from systematizing personnel and also in part as an offspring of "the human relations school [of management], ..." (p. 127). Railroad and life insurance companies had experience in establishing early information systems. No person looms as large in this chapter as Thomas Paine did in Chapter Two and

Theodore Vail did in Chapter Three.[4]

The scope of analysis provided in Chapter Five ("the threshold of the information age: radio, television, and motion pictures mobilize the nation"), by Margaret Graham, is also narrower than provided in Chapters Two and Three. The chapter covers a much shorter period of time– "the 1930s through the 1960s" (p. 137)–than any of its predecessors. It was the time of the vacuum tube. Graham writes: "If we think of the Information Age…as the time when social and economic activities began to be organized according to the logic of information flow rather than materials flow, the vacuum-tube-based technologies defined the threshold of that age" (p. 138). It was during this time period that mass media came into their own. The distinctiveness of Chapter Five's scope of analysis helps broaden the overall picture of the 1900s provided by Chapter Four. Nevertheless, an extended discussion of the rise of newspapers would have been useful. Within its narrow scope of analysis, however, Chapter Five does cover aspects of the three components: information, information infrastructure, and (inter-)action. Issues relevant to this period of time include the loss of diversity in film-making, the Red Scare, the mass media and social control, the fear of a monopoly in TV (RCA), and the type of information conveyed. Graham states that "a consequence of the peculiar brand of freedom the media enjoyed in the United States was the bias toward information in the form of entertainment" (p. 174).

Chapter Six, by James Cortada, is even narrower in scope. Its topic is "progenitors of the information age: the development of chips and computers." Aspects of all three components (information, information infrastructure, and [inter-]action) are covered. Cortada calls the computer chip "a hidden infrastructure" because it is "in everything from microwave ovens … to … palm-held computers …" (pp. 178-179). He lists four "criteria" that a technology must meet before it is adopted by Americans: its performance is no worse than existing technology; it is not more expensive; it is at least nearly as reliable as what it would replace; and it provides "a new functionality …" (p. 179). He also briefly discusses six or seven (depending on how you count) "characteristics of the U.S. economy" (p. 181) that made the development of the computer chip possible: experts and organizations at hand (this could be counted as two); "patent protection"; "creation of a computer industry and demand for its products…"; "physical proximity of developers, manufacturers and vendors…"; this in turn fostered collaboration, competition, and interorganizational recruitment; and "the social and managerial practices of th[e] industry [which] ha[d] long been fairly consistent and contributed to the flowering of this sector of the economy" (pp. 181, 184). The chapter includes sections titled "development of the computer," "history of the computer industry," "knowledge workers and the professions," and "extent of deployment." As Cortada puts it: "Over the past half century a nearly invisible information infrastructure has been under construction across the U.S. economy that is digital and reliable…. We may have, in fact, created the makings of the next turn of the knob in the nature of capitalism" (p. 215).

Chapter Seven, by Richard L. Nolan, also has a quite narrow focus: "information technology management since 1960." The chapter does provide a very useful insight on the dynamic relationship between organizational structure and behavior, on the one hand, and changing technology, on the other. Within this context, aspects of all three components (information, information infrastructure, and (inter-)action) are covered. Nolan claims there are "four distinct stages of organizational learning": they are "Initiation," "Contagion," "Control," and "Integration" (pp. 217-218). Organizations have passed through these stages in two earlier eras, and are now in a third era: the "Network Era…" (p. 218).[5] The chapter is basically a discussion of the three eras. Organizations have gone from "Functional Hierarchy" to "Diamond-Shaped" to an "IT-Enabled Network" (p. 235).

The chapter's section titled "Rise of the Caseworker"– a reference to the type of worker in the third era– provides an interesting but short discussion of the distinction between "Industrial Age" workers, when "companies divided work into work done by two classes of workers…" and workers in the "Information Age, [when] the line between white-collar and blue-collar workers broke down as the sharp distinction between designing work and carrying out that work blurred" (p. 251). Of course, there are blue-collar and service-sector jobs where that "sharp distinction" still exists. Nevertheless, the overall thrust of Nolan's argument is undoubtedly true of many organizations: "Changes accumulated so as to become an information revolution that changed the way companies structured and managed themselves" (p. 217). Nolan's discussion of organizations in the third era underscores Cortada's claim that "we may have, in fact, created the makings of the next turn of the knob in the nature of capitalism" (p. 215).

Chapter Eight, written by Lee S. Sproull, is also narrow in scope. Nevertheless its topic ("computers in U.S. households since 1977") helps broaden the perspective provided by Chapters Six and Seven and helps ex-

tend the analysis provided in Chapter Five. Aspects of all three components (information, information infrastructure, and (inter-)action) are covered in this chapter. Sproull "offers a sociological perspective on the spread, use, and effects of computing technology in the U.S. home from 1977 to 1997" (p. 257). She enumerates four "enduring themes in the history of information technology and media." The first is that even when it comes to acquiring technology there is a class bias. "Second, children are particularly susceptible to the potential consequences of information technology, both positive and negative..." A third theme related to this is how "information technology has affected family dynamics." Finally, Sproull contends that "all information technologies change the boundaries between the household and the larger world" (p. 259). Females have been slower to use computer technology than males, though "by 1995 males and females were equally likely to have a computer in the homeˆÅ" and girls ("nineteen years old and younger") used computers in the home "as frequently as boys..." (pp. 265-266). Children used home computers more than their parents, and computers were "more often used [by children]ˆÅ for entertainment rather than for learning" (p. 267). One study, whose results were published in 1999 (see endnotes 18 and 28), showed that "after statistically controlling for other household variablesˆÅ the net effect of household computers [on performance in school] was found to be rather small..." (p. 267). Telecommuting hasn't exploded quite like earlier champions may have liked: "By the mid-1990s the number of employees using their home computer for full-time telecommuting was still quite small" (p. 271).[6] Sproull briefly discusses "electronic interest groups" (p. 274), "on-line governmental transactions" (p. 274), "electronic discussion groups" (pp. 275, 277), and "Internet groups, sometimes called Usenet groups" (p. 277). She concludes that "finding, building, and sustaining connections among groups of people via electronic communication reminds us that affiliation and sociability can be significant goals for information technology, just as important as efficiency and productivity" (p. 280).

Chapter Nine, by Chandler and Cortada, is dedicated to "the information age: continuities and differences." Their focus is "on the evolving infrastructure for the transmission of information in todayŷÒs Information Age." However, because they "do not attempt to summarize or evaluate how the recipients used the information transmittedˆÅ" (p. 281), they leave aside an important part of the overall explanation of how the nation was transformed by information. The chapter does nevertheless mention some of the types of information being used: information relevant to "business enterprises" (p. 284) "sports, weather, entertainment" (p. 286), "data processing in the office and for messages and entertainment in the home" (p. 288), "spreadsheets, databases" (p. 288), "billing" (p. 291), "accounting or manufacturing and process control" (p. 291), "computer games" (p. 293), and "book[s] of prayers" (p. 298). Chandler and Cortada point out that there have been both continuities and discontinuities "in the infrastructural evolution that began with the postal systemˆÅ" (p. 281) and say that "in balance, the continuitiesˆÅ outweigh the discontinuitiesˆÅ" (p. 282). Thus, aspects of all three components (information, information infrastructure, and (inter-)action) are covered.

The authors also claim that there has been a "continuity in the creation of the infrastructure for the flows of information for well over a century.ˆÅ" (p. 288). Chandler and Cortada attribute this to the emergence of systems: "the U.S. Postal System, the Bell Telephone System, RCA's National Broadcasting Corporation and its competitor Columbia Broadcasting System, IBMÒs System 360 and 370 and their clones" (p. 288). With regard to software, "The historical evolution of software was a four-phase process, occurring over the period from roughly 1950 to the present" (p. 291). Software, however, is the big discontinuity between the present and the past. (In fact, one way in which my own conceptual framework of "information, information infrastructure, and (inter-)action" may break down is that software could be seen as both information and infrastructure.) Chandler and Cortada do make one claim that could be quibbled with: "Unlike books, software can be distributed at almost no cost; one can simply and quickly transmit it over a telephone line, ..." (p. 295). But many books can be accessed on-line as well.

In conclusion, the book's strengths are first, its historical perspective, and second, it helps the reader realize just what is entailed in providing a comprehensive analysis of how the U.S. has been "transformed by information." The greatest weakness of the book is its failure to provide a comprehensive analysis of the "how." A sustained consideration of the impact of public education, publishing, and public libraries would have been helpful. For example, libraries are never mentioned, except to say that "both the filing system [referring to vertical files] and office equipment and supplies to house it ... had roots in the library world" (p. 118). To me, this is a major oversight. The role of public libraries in disseminating information (and transforming our nation) deserves more of an acknowledgement.[7]

Notes:

[1]. See John Seely Brown and Paul Duguid, *The Social Life of Information*, Boston: Harvard Business School Press, 2000.

[2]. For example, in Chapter Two Richard Brown points out that in the new nation "individual states remained powerful and centralization came slowly and incompletely in many areas of government,..." There was "no metropolitan center" in America. Instead, early America had a "national capitalˆÅ [and] a polycentric array of state capitals and commercial centers [that] all required presses" (p. 48).

[3]. Nevertheless, the political, socio-cultural, and technological characteristics of the U.S. have not always worked together to favor an open and informed democracy. One early example of this is the 1798 Sedition Act (p. 50). Richard John, in Chapter Three, discusses limits placed on the circulation of "information dealing with the slavery issue" (p. 68). Graham, in Chapter Five, points out that "the rise of Hollywood and the studio system combined with conservative reaction to the Red Scare and heightened postwar antiunion sentiment to virtually eliminate radical filmmaking" (p. 150). Graham again: "In radio's formative period the goals of cultural unity and homogeneity were held up repeatedly as matters of the highest importance" (p. 152). Between 1920 and 1930, the "movie studios" also censored themselves "to head off a Roman Catholic church push for government censorship" (p. 155).

[4]. Perhaps by this time the opportunity for individuals to play significant roles had decreased–maybe due to the social, political, and economic complexities of the era. Or it could be that the methodology used by the author of this chapter did not lend itself to pointing out the role played by individuals. An extended consideration of the role that individuals play in the unfolding of history, and whether individuals can play greater roles at some times but not at other times, is beyond the scope of this review.

[5]. Just when this third era will end is a bit unclear. On page 218, Nolan claims that this third era "is expected to continue until 2010." However, in Figure 7.1, on page 219, the Network Era extends beyond the year 2010.

[6]. Low fuel prices, the importance of "face-time," and the down-sides of working at home were cited as reasons (p. 272). The role of "face-time" comports with Brown and Duguid's analysis of the social nature of information. See in particular their discussion in Chapter Three of *The Social Life of Information.*

[7]. Andrew Carnegie donated money to help establish a library in "the Pittsburgh area" in 1881 and later shared his wealth with other communities (Elmer D. Johnson and Michael H. Harris, *History of Libraries in the Western World*, Third Edition (Metuchen, NJ: The Scarecrow Press, Inc, 1976), 270, 271). "[B]y 1920 he had provided some $50,000,000 for the construction of no fewer than 2,500 [library] buildings. ˆÅ It is true that in some cases the libraries begun in substantial buildings never fulfilled their promise, and were poorly stocked and staffed, but in most cases the libraries were continued and provided at least a moderate amount of library service for millions of people" (Ibid., 271). According to calculations provided at the web site http://stats.bls.gov/cpihome.htm on June 5, 2001, $50 of 1920 money is worth $442.25 in 2001. That would mean that CarnegiêÒs $50,000,000 would be worth nearly half a billion today.

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