
Systems of Information: The Long View

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ABSTRACT

In response to the perceived (by some) onset of an information society, historians have begun to study its roots and antecedents. The past is replete with the rise, fall, and transformation of *systems of information*, which are not to be confused with the narrower computer-mediated world of *information systems*. The history of systems of information—which for digestibility can be labeled *information history*—lacks neither scale nor scope. Systems of information have played a critical role in the transition to, and subsequent development of, capitalism; the growth of the state, especially the modern, nation-state; the rise of modernity, science, and the public sphere; imperialism; and geopolitics. In the context of these epochal shifts and episodes in human thinking and social organization, this essay presents a critical bibliographic survey of histories—outside the well-trodden paths of library and information-science history—that have foregrounded, or made reference to, a wide variety of systems of information.

THEORIZING “SYSTEMS OF INFORMATION” HISTORY

“A map of the world that does not include Utopia is not worth glancing at,” said Oscar Wilde (1905 [1891], p. 40), “for it leaves out the one country at which humanity is always landing.” Historians, however, are usually uneasy about deliberately landing on the shores of Utopia. The hype that has formed the landscape of the information revolution and its information-society hinterland has mostly failed to spark visceral celebrations among historians, whose primary concern is, of course, the past, not the future. It is true that for some who have chosen to examine the antecedents and prehistory of the information age, simple, linear expla-

nations of technological progress that culminate in a supposedly revolutionary information society have proved hard to resist.¹ But others have sought to play down both the arrival of an information-society break in history and the social importance of digital advances. They have done this by exploring subjects that suggest “we have been here before” (Cortada, 2002; Darnton, 2000; May, 2002, pp. 19–28; Robins and Webster, 1999, pp. 89–110); or, as one set of historians communally proclaimed in the midst of the Internet boom of the 1990s, by asserting that “much of the millenarian optimism being generated by net gurus . . . about globalisation, democratic values, consumer choice, empowerment, market access, education, consumption patterns and material progress is anything but new” (Morgan, 2001, pp. 1–2). Few, in any case, have ventured to historicize systems of information.

We use the term *systems of information* deliberately. The history of *information systems* takes on a vastly different meaning, shifting well beyond its anchorage in digital information technology, if it is reconfigured as the history of *systems of information*.² The provision of systems of information has a long, indeed ancient, lineage (Hobart & Schiffman, 1998). Yet it is only recently that the history of systems of information provision—or, to give it a more digestible label, *information history*—has been formally recognized.

In seeking to define a *system of information* (as opposed to the IT-bound *information system*) we take our cue in part from Licklider’s (1965, p. 6) discussion of systems for the promotion, generation, processing, management, and renewed application of expressed thought.³ We might credibly construe these as systems that create information through social means. Consequently, the history of systems of information is, admittedly, an extremely wide and potentially unwieldy field; just as what constitutes a system is limited only by the imagination (Rayward, 1996, p. 4). It is a field that could plausibly encompass studies as varied as the role of church bells in the communications soundscape of medieval and early modern towns (Garrioch, 2003); the contribution of the mail-order catalogue to the rise of consumer society in the late nineteenth century (Keller, 1995); or the development, beginning in the 1950s, of the electronic payment systems that have become central commercial transactions in everyday life (Stearns, 2011).⁴

Notwithstanding the difficulties that arise from considering almost any aspect of human culture to possess an information dynamic, we are more than comfortable with adopting a holistic approach. Systems of information—whether newspapers or computers, telegraph networks or libraries—can be viewed historically in and of themselves. But to reveal their true historical relevance and meaning, they need to be contextualized in wider historical developments in which they originated and operated. Much more than this, however, because of the importance and ubiquity of

systems of information, we suggest that investigations of the major categories of history can themselves be enriched by giving them an information spin that reconfigures their orientation.

Looming large in considering the legitimate components and workable parameters of the information-history field is the question of how to define and delimit “information” (which is typically associated with data and facts) in respect to “culture” (which is more likely to be connected with experience, consciousness, and representation). Should the Shakespearean playhouses and theatrical productions studied by Lora Taub Pervizpour (2006), alongside other types of early commercial entertainment, be considered parts of information’s direct contribution to capitalism? For present purposes, it is sufficient merely to suggest that the boundary between the two concepts is fuzzy and, therefore, that the scope, in this respect, of early modern European “information” merits additional study.

In seeking an inclusive definition of information, we gravitate toward the deliberately loose perspective of Norman Stevens (1986), who a quarter of a century ago formed the thought that information “may be defined as the factual data, ideas, and other knowledge emanating from any segment of society that are identified as being of value, sometimes gathered on a regular basis, organized in some fashion, transmitted to others, and used in some meaningful fashion” (p. 9). As the importance of information—as Stevens defines it—grew, so also did the number and type of institutions and organizations involved in the creation, production, collection, organization, dissemination, interpretation, and use of information; and collectively these organizations and institutions make up what is today commonly referred to as the “information industry” (p. 23). Because today’s information industry constitutes but one specific historical manifestation of this collectivity, we prefer to speak of “systems of information.”

In hinting at the need to adopt a panoramic field of vision in order to reach an understanding of what constitutes information history, we do not wish to underplay the importance of research based on recent technological perceptions of information. Unlike technically determined studies, which tend toward the vapid, studies based on an acknowledgement that society shapes technology, or is at least intimately bound to it, have the potential not only to inform more broadly but also excite. In this regard, it should be recalled that one of the main traditions of information theory was gestated during the first half of the twentieth century within the context of engineering complex control systems—such as telephone networks, electrical grids, and naval artillery-fire systems. But as Mindell (2002) has shown, these systems contained human as well as physical components. Information history—even when the subject matter lies in the

history of technologies of information broadly conceived—does not have to, and indeed must not, be “socially poor.”

By foregrounding the “social” in information history, historians have been able to range widely in terms of both subject and period: choosing “society” rather than “technology” as a starting point offers more options. An example of the potentially paralyzing eclecticism of information history can be found in the papers read at the 24th Irish Conference of Historians held in 1999. Following a keynote address by Elizabeth Eisenstein, author of the seminal *The Printing Press as an Agent of Change* (1979), delegates were introduced to an astonishing variety of information-history topics, including perceptions of the link between spying and tyranny in the Greek polis; news and information in the papyri of Greco-Roman Egypt; networks of power among Huguenot refugees; the birth of bureaucracy in revolutionary France; the improvement of communication in Victorian freight markets; publicity, propaganda and the press in India, 1880–1920; intelligence and the Cold War; and communication and political power in the work of Jurgen Habermas. The striking variety of information histories presented in this one conference is in fact replicated more widely, as recent bibliographic and methodological assessments of the field have shown (A. Black, 2006; Cortada, 2012; Edwards et al., 2011; Weller, 2008; Weller, 2010; Williams, 2009).⁵

It is not the purpose of this article to reprise or repackage these assessments. Nor do we aim to write anything approaching a comprehensive history of (systems of) information or suggest what form it should take. Such a history would undoubtedly include the history of libraries and the history of information science; and some might wish to see the history of the computer and computing be given a prominent place also. However, these fields have already attracted considerable attention and have developed their own academies and discourses (C. Burke, 2007; Campbell-Kelly et al., 2013; Cortada, 1993; Goedecken, 2010; Haigh, 2011; Rojas and Hashhagen, 2000). Consequently, we choose to leave them out of our present discussion. In doing so, in fact, we are able to make best use of the space that is thus created to introduce history-minded scholars in library and information science and in computing to “information-history” texts from outside their domains.

We do not wish to position information as a phenomenon through which all history can, or should, be viewed. It is simply our intention to highlight the importance and ubiquity of information historically, in what are accepted as familiar historical processes and over what the *Annales* historians termed the “longue durée” (P. Burke, 1990). In adopting the “long view,” while at the same time eschewing comprehensiveness, we are naturally forced to select a limited number of historical lenses through which to spy past systems of information. Further, in order to best empha-

size the critical role information has played in past societies, the categories we have selected—the transition to, and subsequent development of, capitalism; the growth of the state, especially the modern, nation-state; the rise of modernity, science, and the public sphere; imperialism; and geopolitics—have necessarily needed to be synthetic and large scale. These categories possess a certain temporal dimension, and were chosen with this in mind; but it would also be possible to examine information pasts in the context of themes that are not chronologically bound, such as war (Agar, 2003, pp. 201–62; Grier, 2005, pp. 145–58; P. Richards, 1991), or information work (Abbott, 1988, pp. 215–246; Blok & Downey, 2003; Downey, 2003; Lowe, 1987; McKercher & Mosco, 2007; Rosenhaft, 2003; Schement, 1989).⁶ In the context of the epochal shifts and episodes in human thinking and social organization that we have chosen as categories of analysis, this essay presents a critical bibliographic survey of histories that have foregrounded, or made reference to, a wide variety of systems of information.⁷

THE TRANSITION TO CAPITALISM

Producing and selling information to make a profit—information as a site of capitalist development—did not commence with the twentieth-century arrival of digital computers or of the giant corporation. Already by the sixteenth century, information began to play a vital role in the historical transition to capitalism and the subsequent expansion of the capitalist political economy. On one hand, some forms of information production became areas of capitalist enterprise in their own right. On the other hand, perhaps more important, information of diverse kinds was developed as a critical input into other emerging businesses in agriculture, manufacturing, and finance.

It is a commonplace that the early modern European publishing industry constituted an exemplar of this process. Within just a few decades of the appearance of printing (Febvre & Martin, 1997 [1976]), most of the books, and later newspapers as well as cheap plebeian genres like broadsides, pamphlets, and ballads (Watt, 1991; Neuburg, 1977), quickly constituted what historian Peter Burke has called “print capitalism” (2000, pp. 72–73, 149, 160, 165, 173, 178). Parisian publishers, as Robert Darnton (1979) showed thirty years ago, intended that the French Encyclopedia (and a flock of related publications) should be a paying proposition.

Emergent forms of private property in information were ratified and supported by new or significantly revised areas of law: trade secrets, copyrights, and patents (P. Burke, 2000, pp. 153, 162; May & Sell, 2006). The first copyright statute, dating to 1710 in England, places such laws squarely within the history of capitalism’s rise. Often such laws remained functionally dissimilar, however, to those with which we operate today; they entangled support for private property claims with surveillance and

ensorship on behalf of monarchical states. Carla Hesse (1991) offers an insightful analysis of how this dual role collapsed and was redefined during the French Revolution. Mark Rose (1993) shows that, in the quite different case of England, the copyright act of 1710 attained something approaching a modern footing only in the 1770s. Adrian Johns (2009) provides a more wide-ranging and provocative reinterpretation of intellectual property “piracy” as an engine of societal change in its own right.

Turning to the wider contributions made by information as an input into more diverse and encompassing processes of capitalist development, many new kinds of information were being imagined, established, and actively promoted. As Boyd Rayward (2011) has shown in an insightful study of public information bureaux in seventeenth-century France and Britain, a goodly share of these efforts dropped quickly into obscurity: there was no one-dimensional process of visibly compounding growth. Nevertheless, existing historiography has begun to inventory a very wide range of “technologies of knowledge,” as Daniel R. Headrick (2000) calls them.

Institutions and practices for information collection, generation, organization, storage, management, and exchange proliferated within multiform contexts: within the church and—notably as in the case of the French minister Colbert (Soll, 2009)—within the state; in scientific and agricultural societies and in giant trading companies; as well as in result of efforts by sometimes less than fully respectable politically connected promoters like Theophraste Renaudot. From these bases, the system of information provision made substantial contributions to environing processes of capitalist development, via surveys, maps and charts, statistics, and programs for collecting data from and about citizens for purposes of taxation and conscription (Higgs, 2004).

We may sharpen our analysis by recognizing that different concepts of “capitalism” offer distinct vantage points on its informational aspects. Many analysts work with conceptions based not on production but on circulation: market exchanges including commercial trade. Illustrative is Peter Burke’s decision to call his chapter about print capitalism “selling knowledge.” Decisions by merchant groups like the Dutch United East India Company about how to market commodities may be pegged, in this model, to improvements in access to price and market data (P. Burke, 2000, pp. 61, 67, 157–159). So, too, a gradual process of information commercialization may be situated within a supposed “consumer revolution” (P. Burke, 2000, p. 173), speeding market growth for varied information products and services.

This approach is helpful, but it divorces changes occurring in consumption from any anterior historical context. The transition to capitalism in England, the paradigmatic case, compelled large numbers of farmers and tenants off the land, via enclosures whereby once-common fields were literally taken over by agrarian capitalists. This process brought

many people into closer relation with market transactions as they were now “compelled to buy” as commodities things that they could no longer produce for themselves (Wood, 2002, p. 138). The state’s collection of taxes payable only in money acted comparably, to prod people into the market for wage labor. Thus market building and commercialization developed hand in glove with wrenching changes in social class relations.

This epochal shift in turn established the foundations for capitalism’s alterations of the system of information provision. Many informational inputs into capitalist development provided direct and indirect aid to agrarian, financial, commercial, and eventually industrial capital, as it took over productive enterprise and sought to contend with an expanding class of wage workers. The specialized knowledge of political economy, for example, emerged as a determinedly partisan agency of agrarian capitalist development (Perelman, 2000). Again, however, this was not a mechanical or one-dimensional process. Some marketed information products—among them, specific newspapers and pamphlets—played significant roles in the experience and consciousness of wage workers as they developed.

THE SUBSEQUENT DEVELOPMENT OF CAPITALISM

The pursuit of material prosperity through commercial means has existed since the birth of civilization, but the capitalist mode of accumulation might be said to have arrived when the way most people earned a living became dependent on investments of capital (money deployed to make more money) and when individuals began to produce little of what they consumed, relying, instead, mostly on markets to supply their needs. The creation and expansion of *global* markets was a function of exploration, technological advance, the increased circulation of capital derived from credit—and, ultimately, a variety of systems of information. Capitalism’s early phase was characterized by three distinct types, or modes: mercantile, finance, and agrarian capitalism (the last of these will be discussed below, when we address the intersection of information and modern science). Contrary to the image of early capitalists as impulsive and adventurous risk takers, participation in wider systems of information was critical to the development of both finance and merchant capitalism.⁸

In examining the early history of finance capitalism, Hoffman, Postel-Vinay, and Rosenthal (1999) have demonstrated that far from being a novel feature of mature industrialization, large and impersonal credit markets were soundly embedded in the early modern European economy. Mid-eighteenth-century Paris offers a prime example of vibrant and sophisticated finance capitalism in operation. The provision of private credit to investors went well beyond the tried, tested, and secure lending to the state, the beginnings of the phenomenon of the “national debt” being referred to by Marx (1901, p. 779) as “one of the most powerful

levers of primitive accumulation.” As the preindustrial economy grew and became more complex, opportunities for profit making increased accordingly in areas where investors were divorced from the economic activity they supported. Oiling the wheels of an expanding French credit market was a cadre of Parisian notaries acting as financial intermediaries between lenders and borrowers, and functioning as informal and unnoticed conveyors of information between the two. Notaries transmitted information to lenders and borrowers alike. The information service they offered went beyond what could be obtained via engagement in public-sphere institutions like the café, salon, bookshop, scientific society, or subscription library. In providing information to borrowers requiring knowledge of the best opportunities and to lenders needing to discover the reputation and collateral of borrowers, the work of Parisian notaries reflected an emergent modernity’s confidence in information as a reducer of risk and as a counter to the anonymity that characterized large capitalist markets. Very similar practices likewise characterized the emergence of an early transnational credit system by London-based goldsmith bankers, their agents in other European cities, and the merchants they served with routine access to credit (Neal & Quinn, 2001).

Business, or competitive, intelligence is as old as any aspect of economic life, but it is only recently that it has evolved into a theorized discourse and a fully fledged corporate practice. The gathering of commercial information (not just about competitors but about the circumstances in which business is to be conducted) was an important component of merchant capitalism. As the late-medieval mercantile economy expanded, information about broader contexts became crucial to competitive advantage, constituting the lifeblood of the merchant community, governing decisions about when to invest in particular commodities as well as when and where to ship them (Baskes, 2011). The growth of mercantile capitalism was assisted by the growing availability of information arising from the print revolution. In the seventeenth century, the Dutch East India and Dutch West India Companies became reliant on a complex map-making industry. As well as serving as “geopolitical theatres” in the company boardroom, maps were essential for navigation, territorial expansion, settlement, defense, and administration. In essence, Dutch mercantile capitalism “mapped for money,” to invoke the title of Zandvliet’s (1998) study on the subject. In 1801, in London, the East India Company established a library of documents relating to the economy, culture, and climate of the Indian subcontinent. Materials included maps, surveys, reports, parliamentary papers, books, and vernacular manuscripts.⁹

Mercantile capitalism also developed embryonic forms of “paperwork” bureaucracy and information management (Kafka, 2009, 2012; Soll, 2010). As Holland, and in particular Amsterdam, became the center of the seventeenth-century world economic system, it not only assumed the

status of world printing capital (and center of map making, noted above) but also developed a global market for traded information. Both official and unofficial information flowed into Amsterdam from the rest of Holland as well as from around the world. The port's wide-ranging trading operations produced masses of correspondence as merchants sent back *pro forma* letters containing information on local political developments, trade routes, and commodity prices (Soll, 2009, p. 24).

Although the potential for making profits from overseas adventure was huge, the extended lines of communication that were intrinsic to such operations meant that procedures had to be put in place to reduce risk and safeguard investments. Thus considerable attention was paid to organizing and recording information efficiently. The Hudson Bay Company, which had its headquarters in London, insisted from the outset of its operations in 1670 on good documentary communication from its officers (known as "factors") who supervised trapping operations in the Canadian wilderness. Officers were required to send back annually letters, reports, journals (with daily entries), and financial accounts. In return, officers received written instructions, admonitions, and evaluations of past actions. By the late eighteenth century, the Company was requesting a large amount of the information it required in the form of lists organized according to given forms and headings, as opposed to information provided in narrative accounts. However, these bureaucratic arrangements were not sufficient in their own right. Officers were also expected to use their judgment and discretion: trust compensated for the unavoidable deficiencies in the information-management system (O'Leary, Orlikowski, & Yates, 2002). Thus, it can be seen that the information-management systems of mercantile capitalism were far from *ad hoc* and personal, as Price (1987) has further demonstrated with regard to the inner life and procedures of the mid-eighteenth-century merchant house of Herries and Co., London, in which protocols, which we associate more closely with the age of scientific management, set out in detail the expected daily practices of the clerks.

Returning to systems of information external to the commercial enterprise, aside from the historic and enduring seeking and transfer of information orally and through face-to-face contact,¹⁰ since the advent of print, much commercial information has been obtained through publications aimed at the commercial world. Reference works have existed since Antiquity, but the Renaissance witnessed their rapid expansion in parallel with the growing practice of note taking by humanists; moreover, as the humanist textual corpus expanded, reference works began to incorporate finding aids such as alphabetical organization, indexes, and branching diagrams (Blair, 2010). Reference works for the better execution of commerce activity were a feature of early capitalism and the print revolution. To a significant degree, mercantile capitalism was driven forward by

the proliferation of books on the work and world of commerce: foreign phrase books, calendars, ready-reckoners, conversion tables for foreign exchange, tide timetables and commercial dictionaries, and works on navigation and geography (J. Burke, 1985, pp. 116, 121; P. Burke, 2000, p. 159).¹¹ However, the production in this period of reference works on commerce was small compared to the output of such sources during industrialization when there was an explosion in the publication of railway timetables, statistical digests, almanacs, guides, maps, and newspapers (Fyfe, 2009).¹²

Regarding the last of these examples, newspapers have from their inception been vehicles for the dissemination of commercial information, most obviously in the form of advertising (in Britain, the earliest capitalist economy, advertising of some kind was present in print from around 1620 onwards) (Harris, 1998), but also in respect of news about markets and broad environmental information relevant to business.¹³ The commercial dimension of early newspapers was reflected in the inclusion in their titles of the term “commercial intelligencer,” as in the case of the *Chester Chronicle, or, Commercial Intelligencer* (1775) and the opaquely named *New Orleans Price Current, Commercial Intelligencer and Merchants* (1841). A journal entitled *Commercial Intelligence* was founded in Britain in 1898. From the outset the insurance industry was based on knowledge of the context and risk of ventures. The weekly newspaper *Lloyd’s List* was compiled for this very purpose, offering, from its foundation in 1734, vital information for merchants’ agents and insurance underwriters (Bromley & Allott, 1975, p. 14).¹⁴ But there is evidence that classified advertising of the kind found in newspapers predates this particular information format. In the seventeenth century, in Paris and London, organizations were established—respectively, Theophraste Renaudot’s Bureau d’adresse and Samuel Hartlib and John Dury’s Adresse of Accommodations—which provided lists of goods and services for sale, of people seeking work and employers seeking workers, of property lost and found, and of imported and local commodities (Rayward, 2011, pp. 33–41, 45–49).

Moving forward to the nineteenth century, improved communications, most dazzlingly the telegraph, contributed to unprecedented commercial expansion. The coming of the telegraph transformed commerce. Movements of capital through the stock exchanges of the world’s major capitals accelerated quickly. By the late nineteenth century, a telegram message between the London and New York stock exchanges could take as little as three minutes (Headrick, 1988, p. 104). Whereas some viewed the telegraph as a potentially democratic medium capable of changing social relations, the technology essentially became an adjunct of commerce, facilitating not simply the speedy buying and selling of commodities but also the timely conveyance of contextual information regarding potential transactions. In the United States, by 1887 nearly nine out of every

ten messages transmitted by Western Union were business related (John, 2000, p. 79). The telegraph vastly reduced the ability of speculators to capitalize on advance information travelling slowly across great distances (a classic example of this is the personal network that enabled the Rothschild family to receive in London the news of Wellington's victory at the battle of Waterloo in 1815, a full day ahead of the government's official messengers, and hence gain a financial advantage).¹⁵ Instead, what the telegraph did was to raise the premium on sound knowledge of the business environment pertaining to a particular investment, one effect of this being the appearance of a market for commodity futures (John, 2000, p. 81).

In terms of there being a systematic and organized approach to the provision of commercial information, this became highly visible in the second half of the nineteenth century (Chandler, 1981), a period in which production and transactions expanded hugely and, more importantly, became much more complex. The "intelligence function" is a necessary component of any system; it may be defined as the scanning of the environment to maintain the adaptability and efficiency of a system (Vriens, 2004, p. 2). In the decades approaching 1900, the operations of business in industrialized nations became more systematic. Conn (1998a; 1998b, pp. 115–150) has highlighted the appearance, in the context of imperial expansion, of the Philadelphia Commercial Museum—a museum to "conquer the world"—which contained an information bureau and exhibits relevant to business enterprises seeking to expand into foreign markets. International exhibitions and trade fairs became important switching centers for information exchange. After the First World War, for example, the Leipzig Trade Fair was highly instrumental in building an extensive trading network in southeastern Europe, the network it tapped into and helped enlarge serving as a commercial information conduit, relaying economic news, finding agents for German firms, and advertising German products (S. Gross, 2012).

In late-Victorian Britain, institutions began to appear in response to the need for a more "scientific" approach to increasing commercial intelligence. Public libraries began to appear after 1850, and from the outset they contained materials that directly assisted the commercial sphere. In 1887 an Imperial Institute was established in London, and the following year the Institute inaugurated a Department of Commercial Intelligence modeled on the Intelligence Department of the War Office (Muddiman, 2011). Following this example, in 1899 the Board of Trade launched a Commercial Intelligence Branch, a public outgrowth of the intelligence work that the Board's Library had been undertaking for over sixty years in terms of collecting trade statistics and other data-recording changes in foreign and colonial tariffs. In 1900 a profit-making enterprise providing

commercial information was opened, also in London: the Commercial Intelligence Bureau (Black & Murphy, 2012).¹⁶

These late-nineteenth-century developments in systems of commercial information provision occurred at a time when capitalism was transitioning from its “anarchic,” or “liberal,” phase into its “managed” mode. To survive, capitalism has periodically had to restructure, or reinvent, itself. The changing economic and social environment of the late nineteenth century made such a repositioning essential. Vastly intensified and diversified economic activity, and an accompanying rise in living standards and in consumer demand, gave rise to the modern corporation, which was distinguishable from the firms of the earlier industrial eras by virtue of its size and complexity. It was also characterized, unlike its predecessors, by professional management (the separation of management from ownership) and a robust hierarchy encapsulated in the term “command and control enterprise” (Drucker, 2003, p. 160). In these conditions of uncertainty arising from scale, and of extended lines of communication, efficient systems of information were at a premium.

In the era of managed capitalism, systems of information were installed at the center of production. Historians of business have emphasized the emergence of “system” in the operations of enterprises in the late nineteenth century (Chandler, 1977, 1992; Yates, 1989; Campbell-Kelly, 1992; Bud-Frierman, 1994; Locker et al., 1996). The rise of scientific management incorporated a (precomputer) information-management revolution. Long before the arrival of the first business computers—in Britain, for example, business computing was inaugurated in the unlikely setting of the confectionery and catering company Lyons in 1954 when it installed a machine called LEO for payroll and stocktaking functions (Land, 2000; Mason, 2004)—business enterprises were investing heavily in new technologies of information, or office, management: “device innovations” like the typewriter, telephone, vertical filing cabinet, comptometer, and duplicating machine. Information was also integral to the new science of management in terms of novel techniques: statistical analysis, graphic representation, the internal memo, the staff magazine, the management meeting, schemes for classifying documents, the procedural manual, and written protocols. In Fordist-style factories, middle managers and supervisors acted as information conduits between higher management and the shop floor. Scientific management required a constant flow of data from the production and marketing processes upon which management could base its decisions. Information was centralized in a bureaucratized hierarchy, workers’ formal informational input into the production process having been abruptly reduced and/or redirected. The move to managed capitalism was also marked by investment in research facilities and linked information bureaux (A. Black, 2011).

The precomputer information-management revolution of a century ago consolidated the essential role played by information in capitalist enterprise. In the new management manuals of the time, systems of information were presented as indispensable factors of production. One such manual asserted: "War has been declared on routine, at least the old routine. . . . Out of the old traditional routine built upon haphazard and custom, there is growing a new routine based on rational analysis and scientific planning" (Childs, Clapp, & Lichtenberg, 1919, p. v). Systematically gathered information—about suppliers, the production process, and markets—was the raw material of scientifically organized, managed capitalism. It is to be observed, consequently, that the acknowledged importance of information to capitalism rose to a level that earlier industrial capitalists, who had instigated the rise of clock time as an organizing feature of workplace life and surveillance (Thompson, 1967; Robins and Webster, 1986), would barely have recognized.

In tracing the intersection of systems of information and the past development of capitalism, we have concentrated on the role these systems played in the accumulation of capital, rather than the pursuit of profit through their sale; that is to say, information not as a market "product" but as a "helpmate" to capitalist enterprise. It is sufficient to say here that as capitalism expanded and readjusted itself in light of changing circumstances, so also did information as a marketable commodity. The explosion of print—and the profits that were made from it—in the eighteenth century (Raven, 2009) was followed in the nineteenth century by a much more blatant, and indeed vigorous, commodification of information than the charges that were levied for the latest novel, or a national or local newspaper. Realizing the commercial demand for international information, the information entrepreneur Julius Reuter founded the Reuters news organization in 1851 (Weller & Bawden, 2006, pp. 145–148), an enterprise warranting the label that in the late twentieth century was mobilized to describe such endeavors: "information industry." In the late-nineteenth century United States, on the other hand, successful urban newspapers such as the *New York Tribune* were classed among the largest "industrial" companies of their time.

THE RISE OF MODERNITY, SCIENCE, AND THE PUBLIC SPHERE

Although scholars are confident that information has been critical to the development of the modern world (Weller, 2011), they are less certain about the question of when Western civilization became distinctly modern. This question can be pursued through an examination of two of modernity's key constituent elements: observation- and experiment-based science; and the public sphere. Eisenstein's (1993) belief in the

role of the Renaissance in setting in motion a “permanent Renaissance” of cultural and intellectual discovery and renewal that has endured to the present bears scrutiny.¹⁷ A rhetoric of “revolutionary” advance obscures as well as reveals; however, certainly the invention of printing—the most notable technological change in the Renaissance, but one that until the last generation or so remained undervalued—had a monumental effect on late-medieval European society and on social change worldwide for centuries thereafter.

The information technology of print expanded the Republic of Letters and inspired the growth of modern science. It facilitated both the “old” (most notably the wider circulation of classical texts) but much more importantly the “new.” The Copernican revolution is a case in point. Increased access to a variety of printed texts perhaps allowed Copernicus to formulate his theory that the earth orbited the sun. As Eisenstein (1993, p. 206) has pointed out: “Given the increased output of dictionaries and other reference guides, given title pages, book lists, and other rudimentary bibliographical aids, Copernicus was able to undertake a search of the literature on a vaster scale than had been possible before.” The printing press became the “principal natural ally of libertarian, heterodox, and ecumenical philosophers” (Eisenstein, 1993, p. 177).

The Reformation was the first ideological—and intellectual—conflict in which information played a critical role. Printing and Protestantism complemented each other. Protestantism exploited the potential of the new mass medium of print to great effect, especially in terms of its propaganda campaign executed through the publication of vernacular-language pamphlets and broadsides, as well as antipapist cartoons (Eisenstein, 1993, pp. 148–151). In England, information in the form of pamphlets, as well as other digestible printed matter, was an important component in the early seventeenth-century opposition to the absolutist, Catholic-inclined Charles I and in the onset and development of the English Civil War (Hill, 1975).

But the counter-Reformation used print too. It hailed the new technology of printing as a gift from God, a providential invention that not only “proved Western superiority over ignorant infidel forces” (Eisenstein, 1993, p. 148) but could also be used to reinforce traditional religious beliefs and eradicate the teachings of heretics. For example, published in Germany in 1487, *Malleus Maleficarum* explained how to identify, capture, and kill a witch. It was soon circulating throughout Europe, stoking hysteria about witchcraft. The print revolution did not simply bring a growth in *new* works but also *more* works, many of them supportive of Catholicism and the Papacy (Eisenstein, 1993, p. 116). Thus, print formed the basis of media offensives on both sides of the religious divide. The print shop of Christopher Plantin in sixteenth-century Antwerp was patronized not

only by Protestants and those seeking to undermine Spanish rule in the Low Countries but also by Catholics, including Philip II of Spain himself (Clair, 1960).

For other scholars, modernity and its defining scientific and public-sphere complexion did not arrive until the Enlightenment, the importance of information to which was central. There are three fundamental facets of modernity: the notion of the emancipated “subject,” or “self,” capable of reason and self-expression outside the influence of the divine; the birth of the idea of progress; and the triumph of the expert. The Enlightenment was characterized by each of these disruptive modes of thinking about both knowledge and the social world. The idea of being “modern” arose in the Enlightenment with the belief, inspired by modern science, in the infinite progress of knowledge and in the infinite advance toward social and moral betterment. Optimistic about the limits of human reason, Enlightenment thinkers promised to bestow order and governability on a chaotic social world through the identification of rules of human behavior, the social world being depicted as a machine or system whose operations can be predicted (Habermas, 1985; McLennan, 1996).¹⁸

Print and publishing have helped shape the ideas and practices of modern science (Apple, Downey, & Vaughn, 2012; Csiszar, 2010; A. Gross, Harmon, & Reidy, 2002). Since the Enlightenment, scientific discovery and publication—along with its associated scholarly apparatus of peer and book review (Gael, 2012; Spier, 2002)—have grown exponentially in response to an accompanying impulse to classify, measure, disseminate, and, eventually, standardize. Systems of classification and measurement did not just appear in the world of books and libraries; they also emerged in medicine, industry, and social administration. The dissemination of scientific knowledge achieved not only national but also international dimensions. Hoare (1998) has located the onset of a European information society not in the late twentieth century (an assumption underpinning the European Union’s Information Society programs that commenced in the 1990s) but some three hundred years earlier, commencing with the establishment of institutions like the Royal Society in London (1660) and the publication of the first scholarly scientific journal, *Journal de Scavans* (1665). This was followed by the first attempts at universal bibliographic control: in 1688 the philosopher and mathematician Gottfried Leibniz, also court librarian to the Duke of Brunswick, suggested an international publication containing all new published works; and at nearby Gottingen University, something approaching this commenced in 1753: the *Gottin-gen Scholarly Announcements*.

Unknowingly anticipating today’s Internet-driven collaborative “open science” movement, and in stark contrast to the modern-day dominance of proprietary science, Enlightenment scholars and intellectuals established, joined, and exploited institutions for the circulation of ideas—from liter-

ary, philosophical, and debating societies, to salons, subscription libraries, and coffee houses. Early modern science was based on cooperation (including collaboration between friends), its network structure dependent on information transfer at both personal and institutional levels (V. Smith and Yeo, 2009; Weingart, 2012). European scientific and philosophical societies freely exchanged their publications in a network of knowledge sharing. Such institutions and networks helped to constitute what Habermas (1989) theorized as the “public sphere.” Public sphere institutions are, in their *idealized form*, zones of civility, independent of the influence of government, the powerful, and private interests; they are rational, critical, open, accountable to their “publics,” and welcoming of a plurality of opinion. In terms of information, they profess equal, unfettered, and liberal (zero or low-cost entry) access to knowledge-generating resources.

The early public sphere did not have an entirely free run, its path being constantly encroached upon by structural interests, power-laden social relations, and illiberal forces: hence Briggs’ and Burke’s (2009, p. 80) notion of the semipublic sphere. In the public realm, the Enlightenment was by no means an information-abundant epoch, untouched by the forces of censorship and the growing commodification of knowledge materials. However, in terms of the internal management and promotion of science, the Enlightenment might be more convincingly judged to have witnessed significant information-management advances. In eighteenth-century Germany, for example, the quest to improve state fiscal administration and resource management became a new science—specifically, a *cameral science*, a term derived from the chamber (*kammer*) in which a prince’s advisors deliberated on such matters as economics, trade, mining, policing, and agriculture. Even something as natural as the growth of trees for timber was subjected, as Lowood (1990, p. 329) has described, to scientific measurement and regulation. The forest became the property not of undisciplined nature but of the mathematician. The forest curator was replaced by the “calculating forester,” schooled by men trained in the administrative “cameral” sciences. Metaphorically, the new breed of forest scientist “planted, grew, and harvested a construct of tables, geometry, and measurements . . . and on it based their calculations of inventory, growth, and yield.” The new science of forest economy not only had a strong informational dimension in terms of the mathematical calculation and quantifying spirit intrinsic to it;¹⁹ it was also information rich in terms of the information-management techniques of journal keeping and observation recording that premised the expert calculations and resource-management decisions that came later. Organized information management among experts became a feature of modern science (Ilerbaig, 2010), although its roots go back to the late middle ages (Soll, 2010; Blair, 2003; Blair, 2010; Krajewski, 2011).

We end this section on the rise of modern science with some examples,

as signposted earlier, from the era of rational agrarian capitalism. In the eighteenth century, market agriculture was strengthened by a flurry of works exploring and explaining model farming methods. One such work was issued by the Bath Society for the Encouragement of Agriculture, Arts, Manufactures, and Commerce, established in 1771. Its aim was the diffusion of useful knowledge for the public utility, and in accordance with this in 1780 it issued *Letters and Papers on Agriculture*, comprising communications from farmers and agricultural observers around the country. Contributions ranged from “Experiments on Plants Eaten or Rejected By Cattle, Sheep and Hogs” to “The Cultivation of Rhubarb.” Earlier, in 1762, Duhamel du Monceau’s *A Practical Treatise of Husbandry* (1762), a report on the latest experimentation in farming, had been released on the basis that agriculture did not owe its rise to the forces of reason but from fact and experience: “It is a branch of natural philosophy, and can only be improved from a knowledge of facts, as they happen.” Such sources of rational, “scientific” information, and the fact of their relatively wide dissemination to interested parties, represented the growth of an open public sphere of circulating knowledge and ideas in an arena of new capitalist endeavor.²⁰

THE STATE

Reductively, the state can be defined as “the apparatus of government and power” (Giddens, 1985b, p. 17). States are characterized by institutions that have the authority—the sovereign or supreme power—to enforce binding, collective decisions on a society. Such institutions include a legal system; agencies of ideology (including religious authorities); and agencies of physical coercion, such as police and military forces, which bestow upon the state a monopoly of violence. States also require the operation of a civil bureaucracy capable of raising taxes and funding wars as well as conducting surveillance of the population (Dunleavy & O’Leary, 1987, pp. 1–2). Regarding the last of these, it is possible to identify two fundamental types of surveillance: direct and indirect. The former involves the physical overseeing of individuals or groups. The latter, which might also be termed “administrative surveillance,” entails the logging, or tracking, of individuals and groups in documents and databases—the operation of what Giddens (1985b, pp. 172–197) referred to as “administrative power” achieved through communication and information storage for internal pacification and force projection. State power, Giddens (1985b, p. 178) posits, presumes “reflexively monitored system reproduction, involving the regularized gathering, storage, and control of information applied to administrative ends.” In any state, political authority depends hugely on the degree to which it is proficient in extracting, retrieving, analyzing, and storing information as well as controlling its communication (Wir-

sing, 1973). Record keeping can in essence be conceptualized as a “technology of power” (Boyes-Watson, 1994–95).

Administrative state records have an ancient heritage. Indeed, scholars have proposed that the origins of writing are to be found not in the desire to communicate speech in a material form (on stone or clay, for example) but in practices of tallying and counting, an important aspect of this being the creation of emblems to represent property and assets. Early writing was a way of recording “ownership,” as nomadic living gave way to settlements that eventually became the first city-states (Hobart & Schiffman, 1998, pp. 32–61). The development of Rome from city-state to empire is stereotypically attributed to aggression, military might, and innovations in material civilization. However, Lee (1993) has shown how Roman government, conquest, and foreign relations were also a function of multiple and sophisticated channels of information, from informal cross-frontier interaction resulting from trade and population migration, to the strategic gathering of information on current activities and affairs across the empire and in foreign territories. Rome also developed a sophisticated system of official record keeping (Vismann, 2008, pp. 71–101). Much later, in sixteenth-century Venice, government of the city-state was based on deliberative councils in which patricians voted and deliberated profusely. In this political system, not only eloquence but also information were crucial tools of statecraft; communication and information resources—from written council debates and manuscript reports, to printed pamphlets, rumor, and graffiti—served as, in De Vivo’s (2007) terminology, “the nerve centre” of government.

In England, state records date back to the middle ages, where in 1086 the first large-scale survey of land and livestock ownership, undertaken for the purposes of maximizing taxation, was undertaken and published in the *Domesday Book*. Within two hundred years, England was awash with official, written legal documents, from writs and contracts, to accounts and feudal deeds. In the context of the time, this amounted to an avalanche of information. It reveals the existence of a fairly widespread literacy much earlier than has previously been thought, prompting Clanchy (1993) to view the period around the thirteenth century as one worthy of the label “information society.” The beginning of systematic state record keeping can be dated precisely to 1199 when King John’s chancellor began the practice of making copies on parchment rolls of all the more important letters dispatched from Chancery in the king’s name (Tosh, 2000, p. 44). According to Elton (1953), famously, the development in state administration moved on rapidly under the Tudors and in particular as a result of the religious changes brought in by Henry VIII: “The plain fact is that Henry VII ascended the throne of a mediævally governed kingdom, while Elizabeth I handed to her successor a country administered on modern

lines" (p. 3). However, it is to be stressed that Elton's argument—that the machinery of government and, it follows, record-keeping practices, underwent a revolution during this period, as the focus shifted from the management of the king's household to a bureaucratic overseeing of national issues—has not gone unchallenged (Coleman and Starkey, 1986).

Higgs (2004) tells the story of how and why over the past five hundred years the state in England and Wales has increasingly involved itself in the collection and manipulation of information on the private citizen. However, the administrative surveillance of citizens was not always conducted by centralized apparatus; rather, for much of the period he examines, it is local powerholders and bodies—feudal lords, the church, guilds and town corporations—that monitored and recorded the citizenry. Slack (2004) has examined the information role of government in seventeenth-century Britain, with particular emphasis on the rise of "political arithmetic"—the accounting of the wealth, strength, and trade of the nation—as a necessary complement to the rapid growth of the military-fiscal state, a responsibility that is nowadays typified by the operation of the census, perhaps the grandest of indirect surveillance mechanisms.

Spatial knowledge of the territory over which jurisdiction is exercised has always been a critical determinant of state power. Maps were not just a means of facilitating imperial conquest and commercial hegemony, they were also an important instrument of state control, a tool for directing "main force" and countering rebellion. The Ordnance Survey in Britain was conceived in the wake of the Jacobite uprising of 1745–46, when Scottish Highland clans mounted a military insurrection in seeking to restore the Stuart dynasty—and by virtue of this, Catholicism—which had ended with the Glorious Revolution and abdication of James II in 1688 (*Jacobite* comes from the Latin for James, *Jacobus*). After the defeat of the Jacobite army at Culloden, remaining bands of rebels escaped capture by fleeing into the mountains of northern Scotland where for months they evaded forces of the Crown unable to navigate through unreadable scenery. The Ordnance Survey, which was formally commissioned in 1791 but had a gestation period stretching back a generation before this, legitimized and reinforced the sovereign entity of the United Kingdom, formed through the union of England with Scotland (1707) and Ireland (1801); or as Rachel Hewitt has put it: "Mile by mile the Ordnance survey painstakingly created an exquisite monochrome image of that new state" (Hewitt, 2011, p. xvii).

States in the era of modernity have possessed precisely demarcated spatial boundaries, the principle of internationally recognized nation-state sovereignty (territorial integrity) being laid down by the Treaty of Westphalia (1648). The informational power of the nation-state was encapsulated in the standardization of time in countries around the world (although, incredibly, as late as 1970 there were still some eighty differ-

ent railway times in the United States). The standardization of “World Time”—an international agreement made between nation-states on the world’s time zones—did not occur until 1884 (Giddens, 1985a, p. 174). The proliferation of growth of transport timetables—devices that graft order onto time and space—further cemented the power of the nation-state (Esbester, 2009).

The evolution of the modern state was also reflected in the birth and increasing sophistication of the passport and identity card as a means of tracking citizens (Agar, 2005; Robertson, 2009; Torpey, 2000). On a grander scale, and more troublingly, the surveillance function of the modern state has been intensified by the appearance of total world war, which has resulted in a massive extension of state power and administrative reach. The information role of the state in times of war is emphasized in work on subjects as varied as propaganda as a tool of warfare, the use of punched-card machines in the Final Solution (Bauman, 1989; E. Black, 2001; Heide, 2009), the communication system underpinning Britain’s aircraft detection system in the Battle of Britain (Checkland, 1998), and in information-management techniques employed in MI5 in the first half of the twentieth century and at Bletchley Park in the Second World War (A. Black & Brunt, 2000; Brunt, 2004).

The development in Britain from the early-twentieth century of a *warfare* state was complemented by the gradual evolution of a *welfare* state. Systems of information have been central to the establishment of institutions aimed at ordering and sometimes improving the welfare and life-chance opportunities of citizens. This was as true of the reform of the new Poor Law (1834)—and the new administrative landscapes it fashioned, including the inauguration of state registration of births, deaths, and marriages (1837) (Driver, 1993)—as it was of twentieth-century arrangements.²¹ Information extracted by, or in conjunction with, the state and its experts by monitoring the activities of marginal, deviant, or potentially disruptive groups amounted to a “science of moral statistics—effectively an information science—as enshrined in the work of pioneering nineteenth-century British social investigators like Charles Booth and Seebhom Rowntree” (Englander & O’Day, 1995).

The twentieth century saw the rise of what Perkin (1989) termed “professional society,” a description based on the proposition that the main facilitator of state power over the past hundred years has been the “modern expert” whose main role has been one of extracting, recording, and categorizing information about individuals and society at large. The government-expert revolution was at base an information revolution (Adkinson, 1978; Stieg, 1980). In this context, Foucault (1995 [1979]) has conceptualized the “disciplinary,” or “carceral” society operating under the panoptic “gaze” of the expert. In tandem, the officials and multiple agencies of profession-led modern states represent—in Weber’s formulation—an

“iron-cage of bureaucracy” (Mitzman, 1985) in which administrative “pa-permongering,” to borrow Tilly’s (1975) term, is rife.

The modern state evolved as an information-processing machine, a social entity analogous, in Agar’s (2003) view, to the computer. However, its informational role has gone well beyond the analysis, organization, and distribution of information it has received, or extracted, from society. The state has also intervened in the provision of information in the public sphere. At times that intervention has been deliberately impartial and censorious, as in the granting of monopolies to certain producers, for example, that of the Stationer’s Company in England (Blagden, 1977; Myers & Harris, 1990), or the granting of privileges to printers in pre-Revolutionary France (Hesse, 1989, pp. 69–97)—highlighting the importance of the state as a facilitator of capitalism.

On other occasions, intervention has been more positively conceived. States have made huge contributions to scientific knowledge and, fittingly, to statistics (Dupree, 1986; Kruger, Daston, & Heidelberger, 1987; Alonso & Starr, 1987). States also have insisted on the legal deposit of all published material in the name of preserving national culture, a role also assigned to the establishment and development of national libraries whose job it has been to oversee legal deposit schemes (Budd, 1994). In addition to national libraries, over the past century and a half, beginning in the United States and Britain, states have also developed public library systems, often funded from a combination of local and central government taxes (Ditzion, 1947; A. Black, 1996).

In the seventeenth century, the birth and growth of newspapers—perhaps the most common and popular reading-based information product before the arrival of the World Wide Web—had profound implications for political and cultural life across Europe (Dooley and Baron, 2001). “Four hostile newspapers are more to be feared than 100,000 bayonets,” said Napoleon (quoted in Briggs & Burke, 2009, p. 88). Fearful of its destabilizing liberalizing potential, states acted aggressively to curtail the spread and influence of the medium. In Britain, for example, a stamp duty (effectively a tax) on newsprint was imposed in 1712, to the detriment of publications aimed at those with low incomes (the duty was not withdrawn until 1855). In the United States, on the other hand, the revolutionary experience of ejecting a colonial master and replacing a monarch with a republic gave newspapers there a significant boost, the state enabling their wide dissemination through favorable postal arrangements that significantly reduced their cost to ordinary citizens seeking to engage in the political and social life of the nation (John, 2000).

Turning to postal services generally, in recent years these have increasingly been the subject of historical research and form a notable aspect of the information-history domain. Following the establishment of the first public mail routes in Europe in the sixteenth century, public postal ser-

vices have developed as a core responsibility of the state. In Britain, for example, the Post Office originated in the early sixteenth century and over the next five hundred years, expanded to become, as Campbell-Smith has exhaustively revealed, the nation's largest employer and effectively the face of the British state for most people in their everyday lives (Campbell-Smith, 2011). The complexion of public mail services is a barometer of the state's efficiency and political nature, and is a good example of how historical investigation of an information phenomenon can tell us less about the history of information than the history of broader society.

IMPERIALISM

Imperialism refers to political-economic relationships by which one country controls another. An imperialist state that gains overseas territories through military conquest and settlement engages in the closely related practice of colonialism. Throughout several centuries, much of the world experienced some version of this fundamentally dominative relationship.²² How did imperialism shape and reshape the system of information provision?—Profoundly.

By the late fifteenth century, demand for slaves, gold, silver, and other luxury items was becoming a propulsive force. As the demand for slaves shifted out of the household and toward other kinds of work, the slave-based plantation in Brazil, the Caribbean, and North America became a supplier of raw materials crucial for European industrialization (Blackburn, 2011). "Industry and Empire," as historian Eric Hobsbawm (1968) emphasized, thus fed into one another in a mutually conditioning circuit. It was not only that the gold and the slaves won by conquest played a role in enlarging capitalist commodity chains; but also that, as European capital developed manufacturing, its need for profitable markets and for new sources of raw materials and labor interlocked forcefully with an already-existing imperialism. Between the sixteenth and nineteenth centuries European states vied with one another to organize realms of preclusive political-economic power across much of Asia, Africa, and the Americas. By the late-nineteenth century, new, technologically well-armed competitors joined and intensified this scramble for territory: Germany, Japan, and the United States. Complex processes of imperial over-reach and inter-imperial rivalry, anticolonial resistance, and revolutionary nationalism render the history of imperialism a rich mine for historians. Within this vast field, an informational locus looms large.

"England's first literary imperialist," as John Parker (1965, p. 38) called the minor Treasury official Richard Eden nearly fifty years ago, published his first book, *A Treatise of the New India*, in 1553.²³ Throughout the succeeding centuries, imperialism brought into being, or extended and systematized, information collection and generation on a very large scale, from map and chart making (Edney, 1997) to economic botany (Brock-

way, 1979; Kloppenburg, 1988, pp. 152–157; Schiebinger, 2004; Headrick, 1988, pp. 209–258) to linguistics.²⁴ Imperialists appropriated valuable knowledge from indigenous peoples: on the medicinal properties of plants, for example, or on how to cultivate particular crops (Cook, 2007; Carney & Rosomoff, 2009). Imperialism also sponsored repeated modernization of the means of information exchange needed for colonial administration and, in many cases, for military operations—notably via great submarine cable systems and affiliated colonial telegraphs (Headrick, 1988, pp. 97–144; Hills, 2002; Winseck & Pike, 2007). Information was also a fundamental aspect of imperial governance, as Christopher Bayly's (1996) study of British India shows. Akin to botanic gardens, libraries and archives became established as repositories for storing and managing the informational treasures seized by conquest, and helped constitute metropolitan-imperial centers of calculation in support of recirculation of knowledge commodities (Parry, 2004).

The work of the British Museum in storing, cataloguing, and displaying artefacts extracted from the British Empire represented a sequestration of knowledge that has led Thomas Richards (1993) to award the Museum the status of "Imperial Archive," a microcosm of the information society of the following century. To aid Britain's imperial project, geography took on the form of an imperial science. From the 1870s onwards, Britain's premier geographical institution, the Royal Geographical Society, offered a program of classes for explorers, civil servants, and other travelers on subjects ranging from surveying, mapping, and photography, to botany, zoology, and geology. The Society also taught the importance of extracting commercial information from those places of potential economic value travelers visited (Jones, 2005).

If, however, imperialism left glaring traces across the length and breadth of the system of information provision, then these were not all of one type. Imperialism bears a profound responsibility for the build-up and tenacious hold of racialized and ethnocentric forms of knowledge.²⁵ In bringing into direct relation those who would be masters and those who were made slaves, nevertheless, imperialism also paradoxically engendered flickers of an enlarged humanism. Moreover, the forms of information propagated through imperial projects did not necessarily attain their intended effect of enhancing the efficiency of control over subjugated peoples. Rather, a complex dynamic encompassed both domination and resistance, signifying that "the weapons of the weak," as anthropologist James Scott (1985) refers to them, shaped and colored the informational projects of the imperialists (Bayly, 1996).

New stature was accorded these issues as the era of formal imperialism came to a close. During the two decades following the Second World War, scores of new nations throughout Asia and Africa joined the already independent states of Latin America to form what Vijay Prashad (2007) calls

“the Third World political project” (pp. xv–xvii). Formal political independence, it turned out, guaranteed national self-determination neither in economy nor culture and information. Long since inserted into commodity chains controlled by imperial powers, Third World countries saw dominative relationships continuing to operate in both spheres. Some of these obstacles were a residue left by colonialism; but some were sites of active development in the present (H. Schiller, 1969). Their call for economic redistribution through a new international economic order soon engendered a related demand for a “new international information order.”

An agenda for change resulted and acquired a high profile within and around the United Nations system. As they recognized that information infrastructures were serving to reintegrate Third World countries into a capitalist world economy mostly controlled by elites in the United States and Western Europe, artists, intellectuals, and some policymakers sought to redress a wide array of contributing mechanisms, from outdated and skewed network infrastructures and unbalanced flows of trade in audiovisual products to lack of access to the rich informational resources that circulated within the metropolitan countries. To break free of this state of “dependency,” reformers held, required nothing less than a reorganization of the world’s information systems and structures.

The demand for a new international information order faltered as a result of aggressive countermeasures undertaken by the administrations of President Reagan in the United States and Prime Minister Thatcher in the United Kingdom. Concerns about domination and inequality in information survived, however, influencing the geopolitics of information and analysis of the “digital divide” in our own time.

GEOPOLITICS

Geopolitics refers to the territorial aspects of the projection of power by states. Its object may be to shape or affect policy in individual countries, regions, or the entire international political economy. Considered in its informational aspect, geopolitics encompasses intelligence gathering, surveillance, and censorship; efforts to organize or reorient the political economy of extranational and sometimes of domestic information infrastructures; and public diplomacy, or soft power, or propaganda.

A good case may be made that a recognizable geopolitics of information is as old as the early modern European state. Historians have chronicled varied initiatives aimed at surveillance, intelligence gathering, and propaganda, for example, in regard to France between 1600 and the Revolution of 1789 (Sawyer, 1991; Soll, 2009; Popkin, 1989) or, even before this, in connection with the earliest resident diplomats of Northern Europe whose dispatches included material—such as sketch maps and reports on military and commercial infrastructure—gathered by agents

acting essentially as paid spies (Adams, 2011; Black and Bryant, 2011).²⁶ During and after the French Revolution, the rise of public opinion as a political force gave heightened significance to the geopolitics of information—which ascended in policy importance (Hugill, 1999).

Mobilizations for “total war,” beginning with World War One (Headrick, 1991, pp. 73–172), brought these issues to a sharp point (Winkler, 2008). Propaganda saturated the national presses of the belligerents, and rival strategies for restructuring the international communications system constituted an important negotiation at the Versailles Peace Conference and afterward (Schwoch, 1987). Throughout the middle decades of the twentieth century, major powers such as Britain, the United States, and Japan struggled to project power extraterritorially through the use of networks and via public diplomacy (Hogan, 1977; Yang, 2011). The pivotal role taken by science-based industry in World War Two led the leading combatants to systematize new programs for the collection and management of strategically valuable scientific information internationally (P. Richards, 1994; Gimbel, 1990).

The geopolitics of information acquired a new cast during the post-war decades. On one hand, as the United States took over the leadership of the global capitalist political economy, it developed information technologies such as radar arrays linked to computer networks (Redmond & Smith, 2000), and implemented massive propaganda programs—not least, to influence the American people (Bernard, 1999; Wilford, 2008)—to prosecute a global Cold War against the Soviet Union and its allies (Saunders, 1999). Expansive—and expensive—information systems and programs became institutionalized, as the state interlocked with high-tech corporations to establish photo reconnaissance, satellite systems, and electronic signals intelligence (Lewis, 2002; Taubman, 2003; Aid, 2009). Satellite systems in particular came to pit U.S. interests against those of its European allies during the establishment of the International Telecommunications Satellite consortia in the 1960s and during the following decade against much of the world around the issue of direct-to-home satellite broadcasts. On the other hand, in the aftermath of decolonization, adherents of an independent Third World launched a critique of the unbalanced and dominative information systems that operated to support the *status quo*. “Today,” wrote Anthony Smith in 1980, “it is . . . widely held that the machinery of information, if it is controlled from outside, merely confirms the receiving country in a state of perhaps more hopeless dependence than before” (p. 27). Amid calls for a “New International Information Order,” the geopolitics of information became a site of open contestation across a widening range of issues. The NIIO was defeated only by the withdrawal from UNESCO of the United States and Britain and by years of pressure stemming from structural adjustment programs foisted

on Third World countries by the World Bank and the International Monetary Fund (H. Schiller, 1989).

The geopolitics of information took yet another new turn during the 2000s as high technology moved to center stage as an object of inter-capitalist competition. All but invisible to ordinary users of the Internet, battles broke out repeatedly over the control of “critical Internet resources”—principally, the system of assigning unique identifiers on which a functioning Internet rests. In these conflicts, the United States, the historical source and center of policymaking for the extraterritorial Internet, contended against numerous other nations including, most significantly, China (Mueller, 2010; D. Schiller, 2011). At the same time, Internet services such as social networks and search engine sites, and new media such as smartphones and tablets, lent themselves to state-directed programs like the U.S. State Department’s “Internet Freedom” initiative—developed with the intention of projecting power extraterritorially under the misleading watchwords of antiauthoritarianism and democracy.

CONCLUSION

The history of systems of information—which for brevity and branding can be labeled “information history”—lacks neither scale nor scope. No period of history is information poor; no historical subject can be considered information free. In proposing the vital importance of systems of information as a category of historical analysis, we are aware that few historians who research and write information history would label themselves “information historians,” even less “historians of systems of information.” Thus, conceptualizing a field called “information history” might, as Cortada (2012) has observed, run the risk of placing the cart before the horse. However, the absence of an academy made up of scholars who would exclusively, or primarily, identify themselves with an “information-history” field does not mean that such a field cannot be acknowledged and promoted. In fact, the variety of histories and disciplines that inform and contribute to the field of information history, as evidenced in the examples we have presented here, should be considered one of its great strengths.

NOTES

1. Jan van Dijk (2012) endorses the notion of successive webs in human history, culminating in a current network, information society (pp. 26–28). Famously, Toffler (1980) identified three waves of human development: the agricultural, the industrial and, finally, the post-industrial—the last of these giving birth to a new, information age.
2. On “information-systems” history, see Bryant et al. (2013); and Mason, McKenny, and Copeland (1997).
3. Licklider terms these pro-cognitive, or *for*-knowledge, systems. Headrick (2000, p. 4) has viewed an information system as a “supplement to the mental functions of thought, memory and speech,” defining it as “the method and techniques by which people organize and manage information.”

4. On the history of information in everyday life, see Aspray & Hayes (2011).
5. See also Nappo (2011) and similar bibliographies in earlier and later issues of this journal.
6. By “information work” we mean occupations, whether professional or not, where the handling and organization of information is the primary purpose, or indeed a central feature, of the tasks undertaken.
7. In offering this discussion, we are mindful of, and grateful for, the contributions made by our students in the Information History course we have offered at the University of Illinois since 2011. Creating and delivering this course has helped us immensely in developing the present discussion.
8. In this respect, the double-entry bookkeeping developed in the era of mercantile capitalism might be considered such a system: see Poovey (1998, pp. 29–91).
9. Memorandum by G. H. Baker on his career at, and history of, the India Office Library, 1883–1931 (1931), Oriental and India Office Collection, European Manuscripts, The British Library, F303/62.
10. The effects of face-to-face contact as a source of information and influence are highlighted by Heindel (1940, pp. 35–49).
11. See also with regard to a number of these formats, but in a slightly later period, Headrick (2000).
12. Regarding statistics, Fyfe (2009, p. 569) observes that after 1820 there was an “avalanche of numbers” aimed at the “taming of chance.”
13. The “Commercial Intelligence” section of the *New York Times* (October 9, 1856) can be viewed online at <http://query.nytimes.com/gst/abstract.html?res=9402E7DE1039E134BC4153DFB667838D649FDE> (accessed September 2, 2011).
14. *Lloyd's List* is predicated by the less famous *Lloyd's News*, which was first published in 1694.
15. However, it is argued that the family's first concern was in fact to take the news to the government (Gray & Aspey, 2004, p. 922).
16. See also *Commercial Intelligence*, July 21, 1900, p. 11, and August 4, 1900, p. 21.
17. For Heimann (1979), the revolution in science predates the Enlightenment considerably.
18. A *negative* perspective would be formed if one described, in accordance with the postmodern critique, a cluster encompassing hedonistic materialism; rule-laden, bureaucratic structures; and control exercised by experts with profession-driven, status-oriented agendas. Countering the Enlightenment's faith in truth, post-structuralist scholars have argued that knowledge is never neutral or detached. In this context knowledge is not an entity but a network of social relationships; discourses of knowledge are mediated, determined, and generated by power, even at the level of the smallest encounters in everyday life.
19. Although as Crosby (1997) points out, the quantifying spirit had medieval roots.
20. Such guidance manuals also became common in the wider world of trade and industry. *The Universal Merchant* (1753), by Say and Owen, was advertised, as indicated in its subtitle, for the “use and *information* [our emphasis] of gentlemen who propose to make a figure in public affairs, as to the merchant, factor, broker, and remitter.”
21. The Poor Law Amendment Act (1834) abolished outdoor—that is, cash—relief, establishing the workhouse as the only means of obtaining assistance in hard times. Individuals could be admitted to a workhouse only if they had been born in the parish that ran it. This made the registration of births critical.
22. The origins and character of imperialism are still much debated. See Wolfe (1997) and Magdoff (1969).
23. For the subsequent literary project, see Brantlinger (1988).
24. In the late-sixteenth century, cartography became a science in its own right, but the backdrop to its development had an imperialist hue. It should be noted, for example, that the Antwerp-based pioneer cartographer Abraham Ortelius, who in 1570 created the first modern world atlas, the *Theatrum Orbis*, was Royal Cosmographer to Philip II of Spain, at the time the world's leading imperial power: see van den Broecke, van der Krogt, and Meurer (1998).
25. The classic statement is Edward Said (1978) and Said (1993).
26. The history of spying and military intelligence is in itself an enormous information-history topic, classic examples being Andrew (2010); Hinsley (1993); and Fishel (1996). These examples, and most intelligence history, do not address the management or technologies of information explicitly; for examples of studies that do, see C. Burke (1994) and Williams and Lipetz (2005).

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