Technology and Ideology: The Case of the Telegraph

By James W. Carey

I

In one of the most famous paragraphs of our most famous autobiography, Henry Adams located the precise moment when "eighteenth-century troglodytic Boston" joined industrial America: "the opening of the Boston and Albany Rail-road; the appearance of the first Cunard Steamers in the bay; and the telegraphic messages which carried from Baltimore to Washington the news that Henry Clay and James K. Polk were nominated for the presidency. This was May, 1844" (Adams, 1931: 5).

Adams signaled the absorption of genteel New England into industrial America by three improvements in transportation and communication. Yet for all the significance attached to the telegraph in that famous passage, it remains a product of one of the least studied technologies, certainly the least studied communications technology. The effect of the telegraph on modern life and its role as a model for future developments in communications have scarcely been explored. The first twenty-three volumes of *Technology and Culture* are virtually without reference to the telegraph. Robert L. Thompson's *Wiring a Continent*, the principal history of the telegraph, is now more than forty years old, takes the story only to 1866, and focuses almost exclusively on the formation of Western Union (Thompson, 1947).

I take the neglect of the telegraph to be unfortunate for a number of reasons. First, the telegraph was dominated by the first great industrial monopoly—Western Union,

the first communications empire and the prototype of the many industrial empires that were to follow. The telegraph, in conjunction with the railroad, provided the setting in which modern techniques for the management of complex enterprises were first worked out, though for the telegraph in what was eventually monopolistic circumstances.[1] Although the telegraph did not provide the site for the first of the titanic nineteenth-century patent struggles (that prize probably goes to Elias Howe's sewing machine) it led to one of the most significant of them in the rewriting of American law, particularly in the great "telegraph war" between Jay Gould and the Vanderbilt interests for control of the Edison patents for the quadraplex telegraph system, the innovation that Gould rightly prized as the "nerve of industry."[2]

Second, the telegraph was the first product—really the foundation—of the electrical goods industry and thus the first of the science- and engineering-based industries. David Noble's *America by Design: Science, Technology and the Rise of Corporate Capitalism* (1977) implies throughout a sharp distinction between forms of engineering, such as civil engineering, grounded in a handicraft and guild tradition, and chemical engineering and electrical engineering, which were science-based from the outset. Much that is distinctive about the telegraph, from the organization of the industry to the rhetoric that rationalized it, derives from the particular nature of the engineering it brought into being. More to the point, the telegraph was the first electrical engineering technology and therefore the first to focus on the central problem in modern engineering: the economy of a signal.[3]

Third, the telegraph brought about changes in the nature of language, of ordinary knowledge, of the very structures of awareness. Although in its early days the telegraph was used as a toy—as was the computer, which it prefigured—for playing long-distance chess, its implications for human knowledge were the subject of extended, often euphoric, and often pessimistic debate. Adams saw the telegraph as a demonic device dissipating the energy of history and displacing the Virgin with the Dynamo, whereas Thoreau saw it as an agent of trivialization. An even larger group saw the telegraph as an agency of benign improvement—spiritual, moral, economic, and political. Now that thought could travel by "the singing wire," a new form of reporting and a new form of knowledge were envisioned that would replace traditional literature with a new and active form of scientific knowledge.

Fourth, and partly for the foregoing reasons, the telegraph was a watershed in communication, as I hope to show later. Now, it is easy to overemphasize the revolutionary consequences of the telegraph. It is not an infrequent experience to be driving along an interstate highway and to become aware that the highway is paralleled by a river, a canal, a railroad track, or telegraph and telephone wires. In that instant one may realize that each of these improvements in transportation and communications merely worked a modification on what preceded it. The telegraph twisted and altered but did not displace patterns of connection formed by natural geography: by the river and primitive foot and horse paths and later by the wooden turnpike and canal.

But the innovation of the telegraph can stand metaphorically for all the innovations that ushered in the modern phase of history and determined, even to this day, the major lines of development of American communications. The most important fact about the telegraph is at once the most obvious and innocent: It permitted for the first time the effective separation of communication from transportation. This fact was immediately recognized, but its significance has been rarely investigated. The telegraph not only allowed messages to be separated from the physical movement of objects; it also allowed communication to control physical processes actively. The early use of the telegraph in railroad signaling is an example: telegraph messages could control the physical switching of rolling stock, thereby multiplying the purposes and effectiveness of communication. The separation of communication from transportation has been exploited in most subsequent developments in communication down to computer control systems.

When the telegraph reached the West Coast eight years in advance of a transcontinental railroad, the identity of communication and transportation was ended in both fact and symbol. Before the telegraph, "communication" was used to describe transportation as well as message transmittal for the simple reason that the movement of messages was dependent on their being carried on foot or horseback or by rail. The telegraph, by ending the identity, allowed symbols to move independently of and faster than transportation. To put it in a slightly different way, the telegraph freed communication from the constraints of geography. The telegraph, then, not only altered the relation between communication and transportation; it also changed the fundamental ways in which communication was thought about. It provided a model for thinking about communication—a model I have called a transmission model—and displaced older religious views of communication even as the new technology was mediated through religious language. And it opened up new ways of thinking about communication within both the formal practice of theory and the practical consciousness of everyday life. In this sense the telegraph was not only a new tool of commerce but also a thing to think with, an agency for the alteration of ideas.

II

A thorough treatment of the consequences of the telegraph would attempt to demonstrate how this instrument altered the spatial and temporal boundaries of human interaction, brought into existence new forms of language as well as new conceptual systems, and brought about new structures of social relations, particularly by fostering a national commercial middle class. These consequences were also displacements: older forms of language and writing declined, traditional social interactions waned, and the pattern of city-state capitalism that dominated the first half of the nineteenth

century was broken up (Carey and Sims, 1976: 219–41). I intend now to concentrate on the relationship between the telegraph and ideas, between, broadly, the telegraph and ideology. I hope also to insinuate throughout some observations on the broader matters noted earlier.

There are three relationships between the telegraph and ideology. Two of them have received some attention, and I will mention them only in passing in order to concentrate on a relationship that has not as yet been investigated.

The first is the relationship between the telegraph and monopoly capitalism, the principal subject of Thompson's *Wiring a Continent*. That is, the telegraph was a new and distinctively different force of production that demanded a new body of law, economic theory, political arrangements, management techniques, organizational structures, and scientific rationales with which to justify and make effective the development of a privately owned and controlled monopolistic corporation. This problem can be looked at as one of the relationships among a force of production, the organizational forms and administrative techniques that realize it, and the explanatory and justifying ideology that guides and legitimates its institutionalization. Unfortunately, even in this context the telegraph has not been investigated adequately, partly because of the tendency to eschew historical investigations and to treat forces of production, *tout court*, as all-encompassing rather than to investigate the particular consequences and ideological implications of particular technologies. Technology as such is too abstract a category to support any precise analysis; therefore, changes in technology go unanalyzed except for classifying them within various stages of capitalist development.

Before the telegraph, business relations were personal; that is, they were mediated through face-to-face relations, by personal correspondence, by contacts among people who, by and large, knew one another as actual persons. The overall coordination of these atomic relations and transactions was provided by the "invisible hand" of the market.

With the telegraph and, of course, the railroads and improvements in other techniques of transport and communication, the volume and speed of transactions demanded a new form of organization of essentially impersonal relations—that is, relations not among known persons but among buyers and sellers whose only relation was mediated through an organization and a structure of management. "The visible hand of management replaced the invisible hand of market forces where and when new technology and expanded markets permitted a historically unprecedented high volume and speed of materials through the processes of production and distribution" (Chandler, 1977: 12). Through the telegraph and railroad the social relations among large numbers of anonymous buyers and sellers were coordinated. But these new and unprecedented relations of communication and contact had themselves to be explained, justified, and made effective. What we innocently describe as theory, law, common sense, religion were means by which these new relations were carried through to explicit consciousness and "naturalized"—made to seem merely of the order of things.

The second connection between ideology and the telegraph resides in the popular imagery, largely religious, that accompanied the latter's introduction. This aspect of the problem has been rather more thoroughly investigated, at least in a general way, within American studies and particularly within what is called the "myth and symbol" school. The telegraph, widely hailed at the time of its introduction as the "noiseless tenant of the wilderness," was clothed in the language of religious aspiration and secular millenarianism, a language Leo Marx names the "rhetoric of the technological sublime." John Quirk and I, thinking more directly of the telegraph and subsequent developments, have called this same language the "rhetoric of the electrical sublime."

There were other technological marvels of the mid-nineteenth century, but the inscrutable nature of the telegraph made it seem more extraordinary than, and qualitatively different from, other inventions. The key to the mystery was, of course, electricity—a force of great potency and yet invisible. It was this invisibility that made electricity and the telegraph powerful impetuses to idealist thought both in religious and philosophical terms. It presented the mystery of the mind–body dualism and located vital energy in the realm of the mind, in the nonmaterial world. Electricity was, in standard terms of the day, "shadowy, mysterious, impalpable. It lives in the skies and seems to connect the spiritual and material" (Czitrom, 1982: 9).[4]

Electricity, the Reverend Ezra S. Gannett told his Boston congregation, was both the "swift winged messenger of destruction" and the "vital energy of material creation. The invisible, imponderable substance, force, whatever it be—we do not even certainly know what it is which we are dealing with … is brought under our control, to do our errands, nay, like a very slave" (Czitrom, 1982: 19). Another preacher of the era, Gardner Spring, exclaimed that we were on the "border of a spiritual harvest because thought now travels by steam and magnetic wires" (Miller, 1965: 48). This new technology enters American discussions not as mundane fact but as divinely inspired for the purposes of spreading the Christian message farther and faster, eclipsing time and transcending space, saving the heathen, bringing closer and making more probable the day of salvation.

There were dissenters, of course, but the general uniformity of reaction to the telegraph demonstrated how it was able to fuse the opposite poles of the electrical sublime: the desire for peace, harmony, and self-sufficiency with the wish for power, profit, and productivity. The presumed "annihilation of time and space" heralded by the telegraph promised to bind the country together just as the portents of the Civil War were threatening to tear it apart. Here the organic metaphors, so easily attributed to German philosophy, floated into American thought as means to describe how the telegraph would change life. As early as 1838, Morse anticipated twentieth-century notions of the "global village." It would not be long, he wrote, "ere the whole surface of this country would be channeled for those nerves which are to diffuse with the speed of thought, a knowledge of all that is occurring throughout the land; making in fact one neighborhood of the whole country" (Czitrom, 1982: 11–12).

And finally, a piece of doggerel typical of the era, entitled "To Professor Morse, In Pleasant Memory of Oct. 9, 1856, at the Albion," expresses the mixture of science, commerce, politics, and pious religious unity that surfaced in popular consciousness with the telegraph:

> A good and generous spirit ruled the hour;
> Old jealousies were drowned in brotherhood;
> Philanthropy rejoiced that Skill and Power,
> Servants to Science, compass all men's good;
> And over all Religion's banner stood,
> Upheld by thee, true patriarch of the plan
> Which in two hemispheres was schemed to shower
> Mercies from God on universal man.
> Yes, this electric chain from East to West
> More than mere metal, more than mammon can,
> Binds us together—kinsmen, in the best,
> As most affectionate and frankest bond;
> Brethren as one; and looking far beyond
> The world in an Electric Union blest!
> (Martin F. Typper, in *Prime*, 1875: 648)

One finds in this rhetoric of the electrical sublime a central tenet of middle-class ideology: that "communication, exchange, motion brings humanity, enlightenment, progress and that isolation and disconnection are evidence of barbarism and merely obstacles to be overcome (Schivelbusch, 1978: 40). The eighteenth-century ideal of universalism—the Kingdom of God and the Brotherhood of Man—included a belief in a universal Human Nature. People were people—everywhere the same. Communication was the engine that powered this ideal. Each improvement in communication, by ending isolation, by linking people everywhere, was heralded as realizing the Universal Brotherhood of Universal Man.

The argument is not an abstract one. Charles F. Briggs and Augustus Maverick, writing in 1858, made the equation precise:

> It has been the result of the great discoveries of the past century, to effect a revolution in political and social life, by establishing a more intimate connection between nations, with race and race. It has been found that the old system of exclusion and insulation are stagnation and death. National health can only be maintained by the free and unobstructed interchange of each with all. How potent a power, then, is the telegraph destined to become in the civilization of the world! This binds together by a vital cord

> all the nations of the earth. It is impossible that old prejudices and hostilities should longer exist, while such an instrument has been created for an exchange of thought between all the nations of the earth (Briggs and Maverick, 1858: 21–22).

In another work of the era, Sir William P. Andrews, justifying the Euphrates Valley Railroad connecting India to Africa, quotes an anonymous writer who got the whole matter rather more correctly:

> Nor can it for a moment be doubted that a line of electric telegraphs between Europe and India must be a successful commercial enterprise, putting altogether out of sight the important moral effects which such a means of rapid communication must of necessity bring about. It may, on the contrary, be doubted whether any more efficient means could be adopted to develop the resources of India, and to consolidate British power and strengthen British rule in that country, than by the formation of the proposed system of railways in central Asia and the carrying out of the proposed telegraph communication with Europe (Andrews, 1857: 141).

An essentially religious view of communication—or one cloaked, at least, in religious metaphors—is as a mediator—a progressively vanishing mediator—between middle-class aspiration and capitalist and, increasingly, imperial development.[5] Max Weber's tour de force retains its original significance in this context; for Weber's archetype of the formation of the Protestant ethic, Benjamin Franklin, reappears in the mid-nineteenth century as the first electrician, the first to release this new force of moral and social progress. But what needs to be more closely investigated is the relationship between a later stage of economic development, new forms of electrical technology, and a transposed body of religious belief. This is particularly true because, from the telegraph forward, technological development came to be housed in professional engineering societies, universities, and research laboratories. As technological development became more systematic, so did the development of justifying ideologies become more consciously planned and directed by these same groups.

III

In the balance of this [selection] I wish to concentrate on the effect of the telegraph on ordinary ideas: the coordinates of thought, the natural attitude, practical consciousness, or, less grandly, common sense. As I have intimated, I think the best way to grasp the effects of the telegraph or any other technology is not through a frontal assault but,

rather, through the detailed investigation in a couple of sites where those effects can be most clearly observed.

Let me suggest some of the sites for those investigations—investigations to be later integrated and referred for elucidation to some general theoretical notions. First, much additional work needs to be done on the effects of the telegraph on language and journalism. The telegraph reworked the nature of written language and finally the nature of awareness itself. There is an old saw, one I have repeated myself, that the telegraph, by creating the wire services, led to a fundamental change in news. It snapped the tradition of partisan journalism by forcing the wire services to generate "objective" news, news that could be used by papers of any political stripe (Carey, 1969: 23–38). Yet the issue is deeper than that. The wire services demanded a form of language stripped of the local, the regional; and colloquial. They demanded something closer to a "scientific" language, a language of strict denotation in which the connotative features of utterance were under rigid control. If the same story were to be understood in the same way from Maine to California, language had to be flattened out and standardized. The telegraph, therefore, led to the disappearance of forms of speech and styles of journalism and story telling—the tall story, the hoax, much humor, irony, and satire—that depended on a more traditional use of the symbolic, a use I earlier called the fiduciary.[6] The origins of objectivity may be sought, therefore, in the necessity of stretching language in space over the long lines of Western Union. That is, the telegraph changed the forms of social relations mediated by language. Just as the long lines displaced a personal relation mediated by speech and correspondence in the conduct of trade and substituted the mechanical coordination of buyer and seller, so the language of the telegraph displaced a fiduciary relationship between writer and reader with a coordinated one.

Similarly, the telegraph eliminated the correspondent who provided letters that announced an event, described it in detail, and analyzed its substance, and replaced him with the stringer who supplied the bare facts. As words were expensive on the telegraph, it separated the observer from the writer. Not only did writing for the telegraph have to be condensed to save money—telegraphic, in other words—but also from the marginal notes and anecdotes of the stringer the story had to be reconstituted at the end of the telegraphic line, a process that reaches high art with the news magazines, the story divorced from the story teller.

But as every constraint is also an opportunity, the telegraph altered literary style. In a well-known story, "cablese" influenced Hemingway's style, helping him to pare his prose to the bone, dispossessed of every adornment. Most correspondents chafed under its restrictiveness, but not Hemingway. "I had to quit being a correspondent," he told Lincoln Steffens later. "I was getting too fascinated by the lingo of the cable."[7] But the lingo of the cable provided the underlying structure for one of the most influential literary styles of the twentieth century.

There were other effects—some obvious, some subtle. If the telegraph made prose lean and unadorned and led to a journalism without the luxury of detail and analysis, it also brought an overwhelming crush of such prose to the newsroom. In the face of what was a real glut of occurrences, news judgment had to be routinized and the organization of the newsroom made factory-like. The reporter who produced the new prose moved into prominence in journalism by displacing the editor as the archetype of the journalist. The spareness of the prose and the sheer volume of it allowed news—indeed, forced news—to be treated like a commodity: something that could be transported, measured, reduced, and timed. In the wake of the telegraph, news was subject to all the procedures developed for handling agricultural commodities. It was subject to "rates, contracts, franchising, discounts and thefts."[8]

A second site for the investigation of the telegraph is the domain of empire. Again, it is best not to assault the problem as an overarching theory of imperialism but, rather, to examine specific cases and specific connections: the role of the telegraph in coordinating military, particularly naval, operations; the transition from colonialism, where power and authority rested with the domestic governor, to imperialism, where power and authority were reabsorbed by the imperial capital; the new forms of political correspondence that came about when the war correspondent was obliged to use the telegraph; and the rise of the first forms of international business that could be called multinational.

While the growth of empire and imperialism have been explained by virtually every possible factor, little attention has been paid to telegraphy in generating the ground conditions for the urban imperialism of the mid-nineteenth century and the international imperialism later in the century.[9] It is probably no accident that the words "empire" and "imperialism" entered the language in 1870, soon after the laying of the transatlantic cable. Although colonies could be held together with printing, correspondence, and sail, the hold, as the American experience shows, was always tenuous over great distance. Moreover, in colonial arrangements the margin had as much power as the center. Until the transatlantic cable, it was difficult to determine whether British colonial policy was being set in London or by colonial governors in the field—out of contact and out of control. It was the cable and telegraph, backed, of course, by sea power, that turned colonialism into imperialism: a system in which the center of an empire could dictate rather than merely respond to the margin.[10]

The critical change lay in the ability to secure investments. There was no heavy overseas investment until the control made possible by the cable. The innovation of the telegraph created, if not the absolute impetus for imperial expansion, then at least the wherewithal to make the expansion theoretically tenable. But it also created a tension between the capability to expand and the capacity to rule.

With the development of the railroad, steam power, the telegraph and cable, a coherent empire emerged based on a coherent system of communication. In that system

the railroad may be taken as the overland extension of the steamer or vice versa, and the telegraph and cable stood as the coordinating, regulating device governing both.[11]

Although the newspaper and imperial offices are among the best sites at which to look for the effects of the telegraph, there are humbler locations of equal interest. It surely is more than an accident that many of the great nineteenth-century commercial empires were founded in the humble circumstances of the telegraph operator's shack. The case of Richard B. Sears of North Redwood, Minnesota, is instructive. One must not forget that Edison and Carnegie began the same way and that the genius of Jay Gould lay in his integration of the telegraph with the railroad. The significance of the telegraph in this regard is that it led to the selective control and transmission of information. The telegraph operator was able to monopolize knowledge, if only for a few moments, along a route; and this brought a selective advantage in trading and speculation. But it was this same control of information that gave the telegraph a central importance in the development of modern gambling and of the business of credit. Finally, it was central to the late nineteenth-century explosion in forms of merchandising, such as the mail-order house.[12]

In the balance of this essay I want to cut across some of these developments and describe how the telegraph altered the ways in which time and space were understood in ordinary human affairs and, in particular, to examine a changed form in which time entered practical consciousness. To demonstrate these changes I wish to concentrate on the developments of commodity markets and on the institutionalization of standard time. But first let me reiterate the basic argument.

The simplest and most important point about the telegraph is that it marked the decisive separation of "transportation" and "communication." Until the telegraph these words were synonymous. The telegraph ended that identity and allowed symbols to move independently of geography and independently of and faster than transport. I say decisive separation because there were premonitions earlier of what was to come, and there was, after all, pre-electric telegraphy—line-of-sight signaling devices.

Virtually any American city of any vintage has a telegraph hill or a beacon hill reminding us of such devices. They relied on shutters, flaps, disks, or arms operating as for semaphoric signaling at sea. They were optical rather than "writing at a distance" systems and the forerunners of microwave networks, which rely on relay stations on geographic high points for aerial transmissions.

Line-of-sight telegraphy came into practical use at the end of the eighteenth century. Its principal architect was a Frenchman, Claude Chappe, who persuaded the Committee of Public Instruction in post-Revolutionary France to approve a trial. Joseph Lakanal, one of its members, reported back to the committee on the outcome: "What brilliant destiny do science and the arts not reserve for a republic which by its immense population and the genius of its inhabitants, is called to become the nation to instruct Europe" (Wilson, 1976: 122).

The National Convention approved the adoption of the telegraph as a national utility and instructed the Committee of Public Safety to map routes. The major impetus to its development in France was the same as the one that led to the wave of canal and railroad building in America. The pre-electric telegraph would provide an answer to Montesquieu and other political theorists who thought France or the United States too big to be a republic. But even more, it provided a means whereby the departments that had replaced the provinces after the Revolution could be tied to and coordinated with the central authority (Wilson, 1976: 123).

The pre-electric telegraph was also a subject of experimentation in America. In 1800, a line-of-sight system was opened between Martha's Vineyard and Boston (Wilson, 1976: 210). Between 1807 and 1812, plans were laid for a telegraph to stretch from Maine to New Orleans. The first practical use of line-of-sight telegraphy was for the transmission of news of arriving ships, a practice begun long before 1837 (Thompson, 1947: 11). But even before line-of-sight devices had been developed, alterations in shipping patterns had led to the separation of information from cargo, and that had important consequences for international trade. I shall say more on this later.

Despite these reservations and qualifications, the telegraph provided the decisive and cumulative break of the identity of communication and transportation. The great theoretical significance of the technology lay not merely in the separation but also in the use of the telegraph as both a model of and a mechanism for control of the physical movement of things, specifically for the railroad. That is the fundamental discovery: not only can information move independently of and faster than physical entities, but it also can be a simulation of and control mechanism for what has been left behind. The discovery was first exploited in railroad dispatching in England in 1844 and in the United States in 1849. It was of particular use on the long stretches of single-track road in the American West, where accidents were a serious problem. Before the use of the telegraph to control switching, the Boston and Worcester Railroad, for one example, kept horses every five miles along the line, and they raced up and down the track so that their riders could warn engineers of impending collisions (Thompson, 1947: 205–06). By moving information faster than the rolling stock, the telegraph allowed for centralized control along many miles of track. Indeed, the operation of the telegraph in conjunction with the railroad allowed for an integrated system of transport and communication. The same principle realized in these mundane circumstances governs the development of all modern processes in electrical transmission and control from guided gun sights to simple servo mechanisms that open doors. The relationship of the telegraph and the railroad illustrates the basic notion of systems theory and the catch phrase that the "system is the solution," in that the integrated switched system is more important than any of its components.

The telegraph permitted the development, in the favorite metaphor of the day, of a thoroughly encephalated social nervous system in which signaling was divorced from

musculature. It was the telegraph and the railroad—the actual, painful construction of an integrated system—that provided the entrance gate for the organic metaphors that dominated nineteenth-century thought. Although German romanticism and idealism had their place, it is less to the world of ideas and more to the world of actual practice that we need to look when trying to figure out why the nineteenth century was obsessed with organicism.

The effect of the telegraph on ideology, on ordinary ideas, can be shown more graphically with two other examples drawn from the commodities markets and the development of standard time. The telegraph, like most innovations in communication down through the computer, had its first and most profound impact on the conduct of commerce, government, and the military. It was, in short, a producer good before it was a consumer good. The telegraph, as I said earlier, was used in its early months for the long-distance playing of chess. Its commercial significance was slow to be realized. But once that significance was determined, it was used to reorganize commerce; and from the patterns of usage in commerce came many of the telegraph's most profound consequences for ordinary thought. Among its first effects was the reorganization of commodity markets.

It was the normal expectation of early nineteenth-century Americans that the price of a commodity would diverge from city to city so that the cost of wheat, corn, or whatever would be radically different in, say, Pittsburgh, Cincinnati, and St. Louis. This belief reflected the fact that before the telegraph, markets were independent of one another, or, more accurately, that the effect of one market on another was so gradually manifested as to be virtually unnoticed. In short, the prices of commodities were largely determined by local conditions of supply and demand. One of the leading historians of the markets has commented, "To be sure in all articles of trade the conditions at all sources of supply had their ultimate effect on distant values and yet even in these the communication was so slow that the conditions might change entirely before their effect could be felt" (Emery, 1896: 106).

Under such circumstances, the principal method of trading is called arbitrage: buying cheap and selling dear by moving goods around in space. That is, if prices are higher in St. Louis than in Cincinnati, it makes sense to buy in Cincinnati and resell in St. Louis, as long as the price differential is greater than the cost of transportation between the two cities. If arbitrage is widely practiced between cities, prices should settle into an equilibrium whereby the difference in price is held to the difference in transportation cost. This result is, in turn, based on the assumption of classical economics of perfect information—that all buyers and sellers are aware of the options available in all relevant markets—a situation rarely approached in practice before the telegraph.

Throughout the United States, price divergence between markets declined during the nineteenth century. Arthur H. Cole computed the average annual and monthly price disparity for uniform groups of commodities during the period 1816–1842, that

is, up to the eve of the telegraph. Over that period the average annual price disparity fell from 9.3 to 4.8; and the average monthly disparity, from 15.4 to 4.8 (Cole, 1938: 94–96, 103). The decline itself is testimony to improvements in communication brought about by canal and turnpike building. The steepness of the decline is probably masked somewhat because Cole grouped the prices for the periods 1816–1830 and 1830–1842, whereas it was late in the canal era and the beginnings of large-scale railroad building that the sharpest declines were felt.

Looked at from one side, the decline represents the gradual increase in the effective size of the market. Looked at from the other side, it represents a decline in spatially based speculative opportunities—opportunities, that is, to turn trade into profit by moving goods between distinct markets. In a sense the railroad and canal regionalized markets; the telegraph nationalized them.

The effect of the telegraph is a simple one: it evens out markets in space. The telegraph puts everyone in the same place for purposes of trade; it makes geography irrelevant. The telegraph brings the conditions of supply and demand in all markets to bear on the determination of a price. Except for the marginal exception here and there, it eliminates opportunities for arbitrage by realizing the classical assumption of perfect information.

But the significance of the telegraph does not lie solely in the decline of arbitrage; rather, the telegraph shifts speculation into another dimension. It shifts speculation from space to time, from arbitrage to futures. After the telegraph, commodity trading moved from trading between places to trading between times. The arbitrager trades Cincinnati for St. Louis; the futures trader sells August against October, this year against next. To put the matter somewhat differently, as the telegraph closed down spatial uncertainty in prices it opened up, because of improvements in communication, the uncertainty of time. It was not, then, mere historic accident that the Chicago Commodity Exchange, to this day the principal American futures market, opened in 1848, the same year the telegraph reached that city. In a certain sense the telegraph invented the future as a new zone of uncertainty and a new region of practical action.

Let me make a retreat from that conclusion about the effects of the telegraph on time because I have overdrawn the case. First, the opportunities for arbitrage are never completely eliminated. There are always imperfections in market information, even on the floor of a stock exchange: buyers and sellers who do not know of one another and the prices at which the others are willing to trade. We know this as well from ordinary experience at auctions, where someone always knows a buyer who will pay more than the auctioned price. Second, there was a hiatus between arbitrage and the futures market when time contracts dominated, and this was a development of some importance. An approximation of futures trading occurred as early as 1733, when the East India Company initiated the practice of trading warrants. The function of a warrant was to transfer ownership of goods without consummating their physical transfer. The warrant did not represent, as such, particular warehoused goods; they

were merely endorsed from person to person. The use of warrants or time contracts evolved rapidly in the United States in the trading of agricultural staples. They evolved to meet new conditions of effective market size and, as importantly, their evolution was unrestrained by historic practice.

The critical condition governing the development of time contracts was also the separation of communication from transport. Increasingly, news of crop conditions reached the market before the commodity itself. For example, warrant trading advanced when cotton was shipped to England by sail while passengers and information moved by steamer. Based on news of the crop and on samples of the commodity, time contracts or "to-arrive" contracts were executed. These were used principally for transatlantic sales, but after the Mississippi Valley opened up to agricultural trade, they were widely used in Chicago in the 1840s (Baer and Woodruff, 1935: 3–5).

The telegraph started to change the use of time contracts, as well as arbitrage. By widely transmitting knowledge of prices and crop conditions, it drew markets and prices together. We do not have good before-and-after measures, but we do have evidence, cited earlier, for the long-run decline in price disparities among markets. Moreover, we have measures from Cincinnati in particular. In the 1820s Cincinnati lagged two years behind Eastern markets. That meant that it took two years for disturbances in the Eastern market structure to affect Cincinnati prices. By 1840 the lag was down to four months; and by 1857—and probably much earlier—the effect of Eastern markets on Cincinnati was instantaneous. But once space was, in the phrase of the day, annihilated, once everyone was in the same place for purposes of trade, time as a new region of experience, uncertainty, speculation, and exploration was opened up to the forces of commerce.

A back-door example of this inversion of space and time can be drawn from a later episode involving the effect of the telephone on the New York Stock Exchange. By 1894 the telephone had made information time identical in major cities. Buyers and sellers, wherever they were, knew current prices as quickly as traders did on the floor of the exchange. The information gap, then, between New York and Boston had been eliminated and business gravitated from New York to Boston brokerage firms. The New York exchange countered this movement by creating a thirty-second time advantage that ensured New York's superiority to Boston. The exchange ruled that telephones would not be allowed on the floor. Price information had to be relayed by messenger to an area off the floor of the exchange that had been set aside for telephones. This move destroyed the temporal identity of markets, and a thirty-second monopoly of knowledge was created that drew business back to New York (Emery, 1896: 139).

This movement of commodities out of space and into time had three other consequences of great importance in examining the effect of the telegraph. First, futures trading required the decontexualization of markets; or, to put it in a slightly different way, markets were made relatively unresponsive to local conditions of supply and demand. The telegraph removed markets from the particular context in which they were

historically located and concentrated on them forces emanating from any place and any time. This was a redefinition from physical or geographic markets to spiritual ones. In a sense they were made more mysterious; they became everywhere markets and everytime markets and thus less apprehensible at the very moment they became more powerful.

Second, not only were distant and amorphous forces brought to bear on markets, but the commodity was sundered from its representations; that is, the development of futures trading depended on the ability to trade or circulate negotiable instruments independently of the actual physical movement of goods. The representation of the commodity became the warehouse receipts from grain elevators along the railroad line. These instruments were then traded independently of any movement of the actual goods. The buyer of such receipts never expected to take delivery; the seller of such receipts never expected to make delivery. There is the old joke, which is also a cautionary tale, of the futures trader who forgot what he was up to and ended up with forty tons of wheat on his suburban lawn; but it is merely a joke and a tale. The futures trader often sells before he buys, or buys and sells simultaneously. But the buying and selling is not of goods but of receipts. What is being traded is not money for commodities but time against price. In short, the warehouse receipt, which stands as a representation of the product, has no intrinsic relation to the real product.

But in order to trade receipts rather than goods, a third change was necessary. In futures trading products are not bought or sold by inspection of the actual product or a sample thereof. Rather, they are sold through a grading system. In order to lend itself to futures trading, a product has to be mixed, standardized, diluted in order to be reduced to a specific, though abstract, grade. With the coming of the telegraph, products could no longer be shipped in separate units as numerous as there were owners of grain. "The high volume sales required impersonalized standards. Buyers were no longer able personally to check every lot" (Chandler, 1977: 211). Consequently, not all products are traded on the futures market because some resist the attempt to reduce them to standardized categories of quality.

The development of the futures markets, in summary, depended on a number of specific changes in markets and the commodity system. It required that information move independently of and faster than products. It required that prices be made uniform in space and that markets be decontextualized. It required, as well, that commodities be separated from the receipts that represent them and that commodities be reduced to uniform grades.

These were, it should be quickly added, the conditions that underlay Marx's analysis of the commodity fetish. That concept, now used widely and often indiscriminately, was developed in the *Grundrisse* and *Das Kapital* during the late 1850s, when futures trading became the dominant arena for the establishment of agricultural values. In particular, Marx made the key elements in the commodity fetish the decontextualization of markets, the separation of use value from exchange value brought about by the

decline in the representative function of the warehouse receipt, and the abstraction of the product out of real conditions of production by a grading system. In the *Grundrisse* he comments, "This locational movement—the bringing of the product to market which is a necessary condition of its circulation, except when the point of production is itself a market—could more precisely be regarded as the transformation of the product into a commodity" (Marx, 1973: 534).

Marx's reference is to what Walter Benjamin (1968) would later call the "loss of aura" in his parallel analysis of the effect of mechanical reproduction on the work of art. After the object is abstracted out of the real conditions of its production and use and is transported to distant markets, standardized and graded, and represented by fully contingent symbols, it is made available as a commodity. Its status as a commodity represents the sundering of a real, direct relationship between buyer and seller, separates use value from exchange value, deprives objects of any uniqueness (which must then be returned to the object via advertising), and, most important, masks to the buyer the real conditions of production. Further, the process of divorcing the receipt from the product can be thought of as part of a general social process initiated by the use of money and widely written about in contemporary semiotics; the progressive divorce of the signifier from the signified, a process in which the world of signifiers progressively overwhelms and moves independently of real material objects.

To summarize, the growth of communications in the nineteenth century had the practical effect of diminishing space as a differentiating criterion in human affairs. What Harold Innis called the "penetrative powers of the price system" was, in effect, the spread of a uniform price system throughout space so that for purposes of trade everyone was in the same place. The telegraph was the critical instrument in this spread. In commerce this meant the decontextualization of markets so that prices no longer depended on local factors of supply and demand but responded to national and international forces. The spread of the price system was part of the attempt to colonize space. The correlative to the penetration of the price system was what the composer Igor Stravinsky called the "statisticalization of mind": the transformation of the entire mental world into quantity, and the distribution of quantities in space so that the relationship between things and people becomes solely one of numbers. Statistics widens the market for everything and makes it more uniform and interdependent. The telegraph worked this same effect on the practical consciousness of time through the construction of standard time zones.

IV

Our sense of time and our activities in time are coordinated through a grid of time zones, a grid so fixed in our consciousness that it seems to be the natural form of time,

at least until we change back and forth between standard and daylight saving time. But standard time in the United States is a relatively recent invention. It was introduced on November 18, 1883.

Until that date virtually every American community established its own time by marking that point when the sun reached its zenith as noon. It could be determined astronomically with exactitude; but any village could do it, for all practical purposes, by observing the shortest shadow on a sundial. Official local time in a community could be fixed, as since time immemorial, by a church or later by a courthouse, a jeweler, or later still the railroad stationmaster; and a bell or whistle could be rung or set off so that the local burghers could set their timepieces. In Kansas City a ball was dropped from the highest building at noon and was visible for miles around, a practice still carried out at the annual New Year's Eve festivities in New York City's Times Square (Corliss, 1952).

Not every town kept its own time; many set their clocks in accord with the county seat or some other nearby town of commercial or political importance. When the vast proportion of American habitats were, in Robert Wiebe's (1967) phrase, "island communities" with little intercourse with one another, the distinctiveness of local time caused little confusion and worry. But as the tentacles of commerce and politics spread out from the capitals, temporal chaos came with them. The chaos was sheerly physical. With every degree of longitude one moved westward, the sun reached its zenith four minutes later. That meant that when it was noon in Boston it was 11:48 a.m. in Albany; when it was noon in Atlanta it was 11:36 a.m. in New Orleans. Put differently, noon came a minute later for every quarter degree of longitude one moved westward, and this was a shorter distance as one moved north: in general thirteen miles equaled one minute of time.

The setting of clocks to astronomically local time or, at best, to county seat time led to a proliferation of time zones. Before standard time Michigan had twenty-seven time zones; Indiana, twenty-three; Wisconsin, thirty-nine; Illinois, twenty-seven. The clocks in New York, Boston, and Philadelphia, cities today on identical time, were several minutes apart (Corliss, 1952: 3). When it was 12:00 in Washington, D.C., it was 11:30 in Atlanta, 12:09 in Philadelphia, 12:12 in New York, 12:24 in Boston, and 12:41 in Eastport, Maine.

As the railroads spread across the continent, the variety of local times caused enormous confusion with scheduling, brought accidents as trains on different clocks collided, and led to much passenger irritation, as no one could easily figure when a train would arrive at another town. The railroads used fifty-eight local times keyed to the largest cities. Moreover, each railroad keyed its clocks to the time of a different city. The Pennsylvania Railroad keyed its time to that of Philadelphia, but Philadelphia's clocks were twelve minutes behind New York's and five minutes ahead of Baltimore's. The New York Central stuck to New York City time. The Baltimore and Ohio keyed its time to three cities: Baltimore; Columbus, Ohio; and Vincennes, Indiana (Bartky and Harrison, 1979: 46–53).

The solution, which was to establish standard time zones, had long attracted the interest of scholars. The pressure to establish such zones was felt more strongly in North America, which averaged eight hours of daylight from Newfoundland to western Alaska. Although standard time was established earlier in Europe, the practical pressure there was less. There is only a half-hour variance in sun time across England; and France, while larger, could be run on Paris time. But England, for purposes of empire, had long been interested in standard time. The control of time allows for the coordination of activity and, therefore, effective social control. In navigation, time was early fixed on English ships according to the clock of the Greenwich observatory; and no matter where a ship might be in the Atlantic, its chronometer always registered Greenwich time. Similarly, Irish time was regulated by a clock set each morning at Big Ben, carried by rail to Holyhead, ferried across the Irish sea to Kingstown (now Dun Laoghaire), and then carried again by rail to Dublin, where Irish clocks were coordinated with English time (Schivelbusch, 1978: 39).

And so it was no surprise when in 1870 a New Yorker, Charles Dowd, proposed a system of standard time zones that fixed Greenwich as zero degrees longitude and laid out the zones around the world with centers 15 degrees east and west from Greenwich. As 15 degrees equals one hour, the world was laid out in twenty-four zones one hour apart.

Dowd's plan was a wonderful example of crackpot realism. The lines were laid out with geometric exactness and ignored geography, topography, region, trade, or natural affinity. Maine and Florida were put in separate time zones. It is a wonderful example of the maxim that the grid is the geometry of empire. Dowd recommended the plan to the railroads, which adopted it provisionally and created an index out of it so that the traveler could convert railroad time to local time by adding or subtracting so many minutes to or from the railroad schedule.

For thirteen years the Dowd system was debated but never officially adopted by the General Time Convention. The railroads tried during that period to get Congress to adopt it as a uniform time system, but Congress would not and for an obvious reason: standard time offended people with deeply held religious sentiments. It violated the actual physical working of the natural order and denied the presence of a divinely ordained nature. But even here religious language was a vanishing mediator for political sentiments; standard time was widely known as Vanderbilt's time, and protest against it was part of the populist protest against the banks, the telegraph, and the railroad.

In 1881, the Philadelphia General Time Convention turned the problem over to William Frederick Allen, a young civil engineer; two years later he returned a plan. It was based on Dowd's scheme but with a crucial difference: it allowed for the adjustment of time zones for purposes of economy and ecology. In his scheme time boundaries could be shifted up to 100 miles away from the geometric lines in order to minimize disruption. Most important, he recommended that the railroads abandon the practice of providing a minute index and that they simply adopt standard time for regulating

their schedules and allow communities and institutions to adjust to the new time in any manner they chose.

In the Allen plan the United States was divided into four time zones, with centers on the 75th, 90th, 105th, and 120th meridians: Philadelphia, St. Louis, Denver, and Reno were the approximate centers. The zones extended seven and a half degrees to either side of the center line. November 18, 1883, was selected as the date for the changeover from local to standard time, and an ambitious "educational" campaign was mounted to help citizens adjust to the new system. On that date Chicago, the railroad hub, was tied by telegraph to an observatory in Allegheny, Pennsylvania. When it reached one o'clock over the center of the Eastern time zone, the clocks were stopped at noon in Chicago and held for nine minutes and thirty-two seconds until the sun centered on the 90th meridian. Then they were started again, with the railroad system now integrated and coordinated through time.

The changeover was greeted by mass meetings, anger, and religious protest but to no avail. Railroad time had become standard time. It was not made official U.S. time until the emergency of World War I. But within a few months after the establishment of railroad time, the avalanche of switches to it by local communities was well under way. Strangely enough, the United States never did go to 24-hour time and thus retained some connection between the diurnal cycle of human activity and the cycle of the planets.

The boundaries of the time zones have been repeatedly adjusted since that time. In general they have been made to follow state borders, but there are a number of exceptions. The western edge of the Eastern time zone was once in eastern Ohio, but now it forms a jagged line along the Illinois–Indiana border. Boise, Idaho, was moved from Pacific to Mountain time, and recently twelve thousand square miles of Arizona was similarly moved. The reasons for such changes tell us much about America's purposes. One gets the distinct feeling, for example, that the television networks would prefer a country with three time zones: east, central, and west.

Standard time zones were established because in the eyes of some they were necessary. They were established, to return to the point of this [selection], because of the technological power of the telegraph. Time was sent via the telegraph wire; but today, thanks to technical improvements, it is sent via radio waves from the Naval observatory in Maryland. The telegraph could send time faster than a railroad car could move; and therefore it facilitated the temporal coordination and integration of the entire system. Once that was possible, the new definitions of time could be used by industry and government to control and coordinate activity across the country, infiltrate into the practical consciousness of ordinary men and women, and uproot older notions of rhythm and temporality.

The development of standard time zones served to overlay the world with a grid of time in the same way the surveyor's map laid a grid of space on old cities, the new territories of the West, or the seas. The time grid could then be used to control and coordinate activities within the grid of space.

V

When the ecological niche of space was filled, filled as an arena of commerce and control, attention was shifted to filling time, now defined as an aspect of space, a continuation of space in another dimension. As the spatial frontier was closed, time became the new frontier. Let me mention, in closing, two other dimensions of the temporal frontier.

An additional time zone to be penetrated once space was exhausted was sacred time, in particular the sabbath. The greatest invention of the ancient Hebrews was the idea of the sabbath, though I am using this word in a fully secular sense: the invention of a region free from control of the state and commerce where another dimension of life could be experienced and where altered forms of social relationship could occur. As such, the sabbath has always been a major resistance to state and market power. For purposes of communication, the effective penetration of the sabbath came in the 1880s with the invention of the Sunday newspaper. It was Hearst with his New York Sunday *World* who popularized the idea of Sunday newspaper reading and created, in fact, a market where none had existed before—a sabbath market. Since then the penetration of the sabbath has been one of the "frontiers" of commercial activity. Finally, when the frontier in space was officially closed in 1890, the "new frontier" became the night, and since then there has been a continuous spreading upward of commercial activity. Murray Melbin (1987) has attempted to characterize "night as a frontier." In terms of communication the steady expansion of commercial broadcasting into the night is one of the best examples. There were no 24-hour radio stations in Boston, for example, from 1918 through 1954; now half of the stations in Boston operate all night. Television has slowly expanded into the night at one end and at the other initiated operations earlier and earlier. Now, indeed, there are 24-hour television stations in major markets.

The notion of night as frontier, a new frontier of time that opens once space is filled, is a metaphor, but it is more than that. Melbin details some of the features common to the spatial and temporal frontiers: they both advance in stages; the population is more sparsely settled and homogeneous; there is solitude, an absence of social constraints, and less persecution; settlements are isolated; government is decentralized; lawlessness and violence as well as friendliness and helpfulness increase; new behavioral styles emerge. That is, the same dialectic between centralization and decentralization occurs on the temporal frontier as on the spatial frontier. On the one hand, communication is even more privatized at night. On the other hand, social constraints on communication are relaxed because the invasive hand of authority loosened.

The penetration of time, the use of time as a mechanism of control, the opening of time to commerce and politics has been radically extended by advances in computer technology. Time has been redefined as an ecological niche to be filled down to the microsecond, nanosecond, and picosecond—down to a level at which time can be

pictured but not experienced. This process and the parallel reconstruction of practical consciousness and practical activity begins in those capacities of the telegraph which prefigure the computer. The telegraph constructed a simulacrum of complex systems, provided an analogue model of the railroad and a digital model of language. It coordinated and controlled activity in space, often behind the backs of those subject to it.

E. P. Thompson finds it ominous that the young Henry Ford should have created a watch with two dials: one for local time and another for railroad time. "Attention to time in labour depends in large degree upon the need for the synchronization of labour" (Thompson, 1967: 70). Modern conceptions of time have rooted into our consciousness so deeply that the scene of the worker receiving a watch at his retirement is grotesque and comic. He receives a watch when the need to tell time is ended. He receives a watch as a tribute to his learning the hardest lesson of the working man—to tell time.

As the watch coordinated the industrial factory; the telegraph via the grid of time coordinated the industrial nation. Today, computer time, computer space, and computer memory, notions we dimly understand, are reworking practical consciousness coordinating and controlling life in what we glibly call the postindustrial society. Indeed, the microcomputer is replacing the watch as the favored gift for the middle class retiree. In that new but unchanging custom we see the deeper relationship between technology and ideology.

Notes

1 See Chandler (1977), esp. Part II.

2 Among the most readable, accessible sources on the patent struggles is Josephson (1959).

3 See Wiener (1948: 38–44).

4 Whereas I have commented on the essentially religious metaphors that greeted the telegraph in the essays cited, Czitrom (1982) brings this material together in a systematic way.

5 By a vanishing mediator—a concept borrowed from Fredric Jameson—I mean a notion that serves as a bearer of change but that can disappear once that change is ratified in the reality of institutions. See Jameson (1974: 111–49).

6 See chapter 1. On changes in styles of journalism, see Sims (1979).

7 Steffens (1958: 834). For a memoir that discusses the art and adversity of writing for the cable, see Shirer (1976: 282 ff.).

8 The quotation is from an as yet unpublished manuscript by Douglas Birkhead of the University of Utah. Birkhead develops these themes in some detail.

9 On urban imperialism, see Schlesinger (1933) and Pred (1973).

10 Among the few studies on the telegraph and empire, the most distinguished is Fortner (1978); see also Field (1978: 644–68).

11 In making these remarks I am much indebted to the work of Fortner and Field.

12 On these matters there are useful suggestions in Boorstin (1973).