

## TIME, SPACE, AND THE TELEGRAPH

James W. Carey

*James Carey is professor at the Columbia School of Journalism and a leading figure in advancing the study of communications history. His book, Communication as Culture, which is the source of the present excerpt, develops a model for examining the implications of early media development in the United States.*

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 semaphore 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. . . .

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: 205-206). 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 months for commerce. But once used to reterms of use graph's mthought. / zation of t

It was tenth century modify wcost of whcally differ St. Louis. the telegraanother, omarket on to be virtu commodit conditions leading his "To be sure all sources distant valuation was change ent (Emery, 18

Under method of cheap and d space. That in Cincinnati and resell i ential is grete between the ticed betwe equilibrium to the differ is, in turn, economics and sellers relevant m in practice

at the Columbia School of Journalism and a leading figure in advertising history. His book, *Communication as Culture, which excerpt, develops a model for examining the implications of early United States.*

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. . . .

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: 205-206). 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 . . . 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 there 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).

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 there 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 decentralization 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 the spread of the colonize s of the pri Stravinsky transform quantity, a so that the becomes se market for and interc same effec through th

## BIBLIOGRAPHY

- Baer, Julius  
*modity E*  
 Benjamin, V  
 court, B  
 Chandler, A  
*gerial R*  
 Cole, Arthu  
 MA: Har  
 the *Unite*  
 vard Uni  
 Emery, Henr  
*Produce h*  
 tory, *Econ*  
 New York  
 Marx, Karl ( *tique of E*  
 Thompson, J  
 ton, NJ: E  
 Wilson, Geo  
 Phillimon



The original bicycle courier. In urban areas, telegrams had to be collected and delivered by squadrons of young messengers. *National Archives of Canada.*



product has to be re-made. With 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

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

an areas, telegrams had to be collected and delivered by

ational Archives of Canada.



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.

## BIBLIOGRAPHY

- Baer, Julius B., and George P. Woodruff (1935). *Commodity Exchanges*. New York: Harper & Bros.
- Benjamin, Walter (1968). *Illuminations*. New York: Harcourt, Brace and World.
- Chandler, Alfred D. (1977). *The Visible Hand: The Managerial Revolution in American Business*. Cambridge, MA: Harvard University Press.
- Cole, Arthur H. (1938). *Wholesale Commodity Prices in the United States, 1700-1861*. Cambridge, MA: Harvard University Press.
- Emery, Henry Crosby (1896). *Speculation on the Stock and Produce Exchanges of the United States, Studies in History, Economics and Public Law* (332.6EM3STX.AGX). New York: Columbia University Press.
- Marx, Karl (1973). *Grundrisse: Foundations of the Critique of Political Economy*. New York: Vintage.
- Thompson, Robert L. (1947). *Wiring a Continent*. Princeton, NJ: Princeton University Press.
- Wilson, Geoffrey (1976). *The Old Telegraph*. London: Phillimore.