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Telephomania: The Contested Origins of the Urban Telephone Operating Company in the United States, 1879-1894

This essay reconsiders the origins of the urban telephone exchange in the United States in the formative era of commercial telephony that stretched from 1879 and 1894. This time span marked the beginning and the end of a distinctive epoch. In 1879, the Boston investors who had secured the ownership of Alexander Graham Bell's telephone patents successfully negotiated an agreement with telegraph giant Western Union to divide the market for electrical communication. Henceforth, Western Union would specialize in telegraphy; the Boston investors in telephony. In 1894, the second of Bell's two fundamental telephone patents expired, opening the telephone market to competition.

This essay is divided into three sections. The first section surveys recent historical writing on the formative era of American telephony and highlights the extent to which two historiographical traditions—called here "triumphalism" and "revisionism"—reached similar conclusions about the early urban telephone exchange. The second section explores four of the most daunting operational challenges that telephone managers confronted: the acquisition of rights-of-way; the forestalling of hostile rate legislation; the routing of telephone calls; and the interconnection of operating companies. With the exception of routing—which was primarily a technical and organizational matter--each of these challenges had a political dimension. The third section considers how an understanding of the formative era of commercial telephony informs our understanding of American telecommunications.

The origins of the urban telephone exchange was doubly contested. Most obviously, it was it the site of considerable uncertainty, tension, and popular protest (which one telephone manager dubbed "telephomania"). In addition, its embeddedness in a distinctive political and cultural context has been forgotten and in some instances repressed. The recovery of this context challenges conventional ways in which we explain the rise of the communications networks that have become such a ubiquitous feature of modernity.

Most recent scholarship on the commercialization of telephony in the United States in its formative era (1878-1920) falls into one of two traditions. The first celebrated the innovativeness of the American Telegraph and Telephone Company (AT&T) and praised it as a socially responsible and technically innovative corporation. The second critiqued AT&T for stymieing innovation and slowing the popularization of the new communications medium.

The first of these traditions can be termed triumphalist in the sense that it views the telephony industry from over the shoulders of the men who would come to command the levers of power at AT&T. AT&T was chartered in 1885 as a wholly owned subsidiary of American Bell, the holding company that owned Alexander Graham's Bell's telephone patents. To reinforce their identification with the inventor, the triumphalists often trace the origins of AT&T back to American Bell. Between 1885 and 1900, AT&T was a long-distance provider, a service far less important then than it has since become. AT&T became a dominant player in the telephone industry in 1900, when, in an exercise in legal legerdemain, it became the holding company for the constellation of telephone operating companies that had licensed Bell's patents, and that would come to be known as the "Bell System."

Though the triumphalists by no means ignored the operating companies, they were rarely their main focus. Instead, they fixed their attention on the creation by AT&T of a long-distance network, the establishment by Western Electric (American Bell's, and later, AT&T's, equipment supplier) of uniform operating standards, and the emergence within AT&T of a research and development laboratory (which acquired a separate identity in 1925 as Bell Labs) to devise innovative solutions to problems such as long-distance telephone transmission. Two innovations midwived by AT&T engineers figure prominently in almost every triumphalist account: the

vacuum tube, which AT&T engineers deployed in 1915 to make possible transcontinental telephony, and the transistor, which Bell Labs engineers invented in 1948 to improve telephone switching.

AT&T triumphalism often verged on the hagiographic, and it is not hard to see why. In its mid-twentieth century heyday, AT&T was not only admired for its tradition of social responsibility and technical innovation, but also one of the largest aggregations of capital and labor in the world. As recently as 1981, AT&T had more assets ($138 billion) and employees (1.04 million) than any other corporation in the United States. That AT&T also owned the largest and most important portfolio of telephone operating companies in the United States seemed almost beside the point—even though this portfolio largely accounted for its enormous size.

AT&T triumphalists in 1984 suffered what in hindsight would prove to be a fatal setback when a federal judge ordered the court-ordered break-up of the Bell System. The break-up of what had been one of the largest organizations in the world was a remarkable testament to the determination of the judiciary to subordinate even the largest aggregations of capital to the discipline of the market. For AT&T triumphalists, however, it was an epic disaster, which they characterized--as the titles from two books on the break-up proclaimed--as either a "Wrong Number" or the "Rape of Ma Bell."[i]

One of the most distinctive features of AT&T triumphalism has been its idealization of the beginnings of the telephone industry in the United States. In book after book, triumphalists hailed early telephone leaders--the inventor Alexander Graham Bell, the mechanic Thomas A. Watson, the promoter Gardiner Greene Hubbard, and the organizer Theodore N. Vail--as remarkable visionaries who astutely foretold the emergence of a vast, socially beneficent communications medium. For MIT political scientist Ithiel de Sola Pool, writing in1977, Bell,

Hubbard, and Vail had a "remarkable record of prescience."[ii] For AT&T policy planner H. M. Boettinger, writing in the same year, the enduring legacy of the first generation was aptly captured by the subtitle of his history of the industry, "Bell, Watson, Vail, and American Life, 1876-1976."[iii]

AT&T triumphalists made much of the predictions of early telephone promoters that, at some point in the future, a telephone network would link every household in the United States. The very language of AT&T's original corporate charter of 1885—which defined its mandate to embrace the provision of long-distance telephony not only in North America but also in the "rest of the known world"—seemed almost providentially to prefigure the subsequent course of events.[iv] Among the most oft-cited of these pronouncements was Bell's confident prediction to a group of English investors in March 1878--a mere three months after the establishment, in New Haven, Connecticut, of the first telephone exchange--that the "ultimate result" of the commercialization of the telephone would be the establishment of a network that would "unite the head offices of the Telephone Company in different cities" so that "a man in one part of the country may communicate by word of mouth with another in a distant place."[v]

Though Bell's prediction may seem prosaic today, it is worth remembering that, in 1878, the practical limitation of telephone service was a mere twenty miles, while, as recently as 1941, 98 percent of all telephone calls within the United States took place within the boundaries of a single state.[vi]

AT&T triumphalists remember Bell primarily as the visionary who bequeathed his blockbuster invention to a grateful world. Fittingly, one of the first outside scholars to whom AT&T executives granted permission to work in their vaunted corporate archive was a biographer of the telephone inventor. The biographer was the distinguished Boston University history professor Robert V. Bruce; Bruce's biography of Bell was published in 1973. Bell lived

long enough to participate in the first transcontinental telephone call in 1915--a pseudo-event, termed by AT&T publicists a "calling ceremony," that was shrewdly capitalized on by its formidable publicity machine. In reality, however, the eponymous founder of "American Bell" and the "Bell System" played no role in the organization of AT&T, and had the decidedly unsettling propensity to make public statements that—had they garnered public attention, which for the most part they did not—might well have made Bell leaders cringe. For example, in 1884, Bell blithely informed a New York newspaper reporter that the telephone companies ought to bury their wires underground, but "will never do it, I fear, until they are required by law to do so."[vii]

Hubbard posed for AT&T triumphalists an even greater interpretative challenge. Hubbard was indisputably a founder of the telephone empire that would eventually come to be dominated by AT&T. Hubbard secured Bell his telephone patents, held a large block of telephone stock, and designed the business strategy of leasing (rather than selling) telephones. Yet Hubbard lacked the confidence of the Boston investors who took charge of Bell's patents in 1878—he had a particularly difficult relationship with American Bell president William H. Forbes--and clashed repeatedly in the following years with American Bell leaders over their treatment of the operating companies.[viii] The magnitude of Hubbard's quarrel with American Bell remained hidden away in the AT&T archives—far from view. Yet hints surfaced in Bruce's biography of Bell, as well as in Arthur Pier's tribute to Forbes. It thus made sense for AT&T triumphalists to get Hubbard off stage as fast as possible, and to highlight his many philanthropic endeavors, such as his key role in the founding of the National Geographic Society.

Hubbard's quarrel with American Bell is worth lingering on for a moment, if only to highlight a feature of telephone history in its formative era that AT&T triumphalists have almost entirely repressed. And that was the extent to which even one of the undisputed founders of the

telephone industry believed that American Bell was imposing undue restrictions on the operating companies that slowed the commercialization of the new technology and exacerbated resentments certain to foster opposition once Bell's fundamental patents expired (which, as everyone knew, they would in 1893 and 1894). For the operating companies to prosper, Hubbard lectured Forbes in 1884, they should be owned by investors in the localities in which they operated, rather than by American Bell.[ix] At present rates were too high—the "rock" on which telegraph giant Western Union almost foundered.[x] To best promote the public interest, Hubbard added, American Bell should behave more like a "quasi-public corporation" by lowering the licensing fees it demanded from the operating companies and encouraging the operating companies to lower their rates. American Bell was making too much money, Hubbard warned, and, largely for this reason, was extraordinarily unpopular. The dangers this posed, Hubbard believed—was something that he understood far better—as the veteran promoter of street railways, gas companies, and water works—than any member of the executive committee of American Bell.[xi]

Hubbard redoubled his criticisms of American Bell following the validation in March 1888 of Alexander Graham Bell's fundamental telephone patents by the Supreme Court. Though AT&T triumphalists often treat the court ruling as a vindication of American Bell's business strategy, Hubbard did not. The unflattering response of the press to the court's ruling—Hubbard explained to an American Bell executive shortly after Bell's patent rights had been affirmed--"shows strongly how unpopular we are": and so long as telephone charges remained too high, there would be "great reason for this fault finding on the part of the public which finds the mouthpiece in the press."[xii]

Hubbard's most unforgivable sin—at least in the eyes of AT&T triumphalists—was his misgivings about the commercial possibilities of long-distance telephony. The vast majority of

telephone traffic, Hubbard reminded Forbes's successor, John Hudson, in 1889, would for the foreseeable future continue to be regional rather than national—just as it was in mail delivery and telegraphy, where three-quarters of the traffic linked commercial centers and its hinterland within a perimeter of 100 miles.[xiii] Hubbard's skepticism about long-distance telephony help explain why he so enthusiastically backed the proposal of Postmaster General John Wanamaker to establish in the Post Office Department a rate schedule that would make the telephone a feeder to the long-distance telegraph network. Such an innovation, Hubbard assured Hudson in 1890, would "ensure our success for many years to come."[xiv] Like so many early telephone leaders, Hubbard remained convinced to his death (in 1897), that long-distance telephony would supplement but not supplant telegraphy, which he had spent almost thirty years trying to reform.

While AT&T triumphalists had good reason to be wary of Bell and Hubbard, they found little to fault in the long telephone career of AT&T's first president, Theodore N. Vail. The idealization—and, indeed, almost the deification—of Vail is a recurrent triumphalist theme. Vail was, declared AT&T executive Alvin von Auw in 1983, in a book-long lament for the soon-to-be dismantled Bell System, not only the "inventor" of the Bell System, but also "one of the two or three foremost organizing geniuses in the history of American industry."[xv] For Boettinger, superlatives seemed almost beyond the point. More like a "great artist" than a "cold, professional bureaucrat," Vail had mastered the "craft" of management to realize a "personal" vision—the idea that "every person should have access to a telephone" and that all telephones should have access to each other: "The intellectual and human aspects of his grand design remain the foundation structure of telecommunications in our day."[xvi] Despite the present "anti-technological mood" (Boettinger was writing in the late 1970s), he regarded telephone policy as "benign" and credited this "happy outcome" to "Vail's humane vision of universal service."[xvii]

Two features of Vail's long telephone career struck the triumphalists as particularly significant. The first was his enthusiastic support for the construction of a long-distance telephone network during his first term as AT&T president (1885-1887). The second was his expansive vision during his second term as AT&T president (1907-1910) of a telecommunications network dedicated to "universal service."

Trimphalists often regarded Vail's support for long distance as his principal contribution to the commercialization of telephony in the period prior to the expiration of Bell's patents in 1894. Such accounts lingered over Vail's celebrated quarrel in 1887 with the Boston investors: Vail favored expanded service; the investors higher dividends. When the investors refused to budge, Vail resigned—unwilling, or so Boettinger contended, to "compromise the most profound ideal of his life."[xviii] Overlooked in these accounts—as well as in most recent academic scholarship about Vail—was Vail's decision in 1887 to retain the presidency of the New York-based Metropolitan Telephone Company, the Bell licensee in Manhattan, and the largest telephone operating company in the world. Vail remained at Metropolitan until 1889, where he would oversee the installation of underground conduits for the city's central business district—an impressive achievement duly commemorated by popular journalists in the 1910s, yet one that more recent AT&T scholars almost invariably ignore.[xix]

The second achievement of Vail's that the triumphalists praise was his endorsement, during his second term as AT&T president (1907-1919) of "universal service." Though the precise meaning of "universal service" remains somewhat vague (which is hardly surprising, given its inherent abstractness), triumphalists link it not only with the interconnection of existing telephone exchanges but also with the popularization of telephone service. Vail's 1887 departure from AT&T, they contend, marked the onset of an unfortunate interlude in AT&T history that was characterized by conservatism, competition, and, eventually, a potentially crippling financial

crisis. Not until Vail's return in 1907 would the situation improve. Missing from these accounts is any recognition of the extent to which telephony had been popularized in the period between Vail's two terms as AT&T president. Though the popularization of telephony took place throughout the country, nowhere had this process advanced further than in the major urban centers such as New York—where they had been hastened by changes that Vail himself had earlier overseen.[xx]

The revisionist critique of AT&T was, in some ways, the mirror image of the triumphalists' celebration. Whatever the triumphalists praised, the revisionists attacked. In so doing, they too neglected the urban telephone exchange in the period between 1878 and 1894. Far more important, from the revisionists' perspective, were a number of developments that followed the expiration of Alexander Graham Bell's telephone patents. No consensus has emerged as to which post-1894 developments were most fundamental. Some highlighted the competition the Bell licensees encountered from non-Bell operating companies (known as the "independents"); others the more expansive vision of the possibilities of telephony that competition fostered.[xxi] Still others underscored the role of consumers in re-imagining telephone service as a popular communications medium.[xxii] All shared the presumption that few fundamental innovations took place in the period prior to 1894--with the obvious exception of the advent of long-distance telephony and the invention of the telephone itself. Like the triumphalists, they took it for granted that the most important industry leaders in the period prior to 1894 were the Boston-based investors who dominated American Bell and, after 1885, AT&T. Unlike the triumphalists, they characterized the business strategy that telephone leaders pursued as highly conservative (focused as it was on the control of key patents and the reaping of windfall profits) and little different from that of the notoriously reactionary telegraph giant Western Union.

* * *

This essay differs from both the revisionists and the triumphalists in underscoring the significance of innovations that took place in the telephone industry prior to 1894 and in the operating companies rather than at AT&T. And in particular, it highlights innovations that originated in the operating companies in the nation's largest cities. Telecommunications historians often forget that, in this period, the urban operating company was the core of the industry, and that the operating companies in New York and Chicago were, respectively, the first and second largest telephone operating companies in the world. [xxiii]

The rise of the large urban operating company was the work of many people—and is best thought of as a grand collaboration between telephone managers, telephone subscribers, and the city governments in which operating companies held franchises. Key figures included the general managers of urban exchanges: Charles N. Fay in Chicago; Edward J. Hall. Jr., in Buffalo; Morris F. Tyler in New Haven. The principal forum for the exchange of ideas was the National Telephone Exchange Association (NTEA), a trade group for telephone operating company managers that met in various cities more or less annually between 1880 and 1890. The NTEA was by no means a secret organization: its secretary published its proceedings and the trade press routinely reported on its activities. Yet it has been all but forgotten by recent telephone historians. For example, a recent historian of Western Electric has observed—echoing what has become a telephone history cliché—that American Bell general manager Theodore N. Vail hosted the <u>first</u> meeting of operating company managers in 1885.[xxiv] This claim is doubly misleading. Not only had operating company managers been meeting since 1880, but Vail was in 1885 president <u>not only</u> of AT&T, but also of the Metropolitan Telephone Company in New

York. Furthermore, the impetus for this meeting was not Vail's determination to bring order out of chaos, but, rather, the realization by American Bell executives that it had become necessary to assuage the growing frustration of operating company managers.[xxv] Interestingly, there is no evidence that Vail attended a single NTEA meeting, though he was made an honorary member in 1885.[xxvi]

The interests of American Bell and the operating companies were by no means aligned. The investors who dominated American Bell regarded the operating companies primarily as a revenue source. This was altogether understandable, since their primary source of income was the licensing fees that the operating companies paid each year for the use of Bell's patents. Operating company managers, in contrast, viewed American Bell as an often arrogant and imperious rentier. The smoldering resentment of operating company managers at American Bell's licensing arrangements was a principal reason for the founding of the NTEA.[xxvii] While American Bell executives might occasionally convene meetings of operating company managers—as Vail did in 1885—they had remarkably little influence on how the operating companies were run. This point is worth underscoring, since recent telephone historians have mistakenly assumed that operational decisions were somehow made in the president's office of American Bell. Nothing could be further from the truth. If we are to understand how Bell's invention became transformed into a commercially viable innovation, we must shift our angle of vision from the olympian calm of the president's office at American Bell to the hustle and bustle of the switchboard room of the telephone operating companies in the nation's major urban centers. For it was here that the principal operational challenges of telephone service were met.

The relationship between American Bell and the operating companies in the 1880s remained loose, contentious, and strained. Individual Bell-associated operating companies experimented with different kinds of equipment and pursued divergent business strategies. No

two operating companies were alike. To be sure, none were managed like Western Union: all combined conservative financing with a highly innovative business strategy. Yet a substantial degree of variation remained.

Nowhere was the ubiquity of diversity more evident than in the ongoing, complex, and sometimes exasperating negotiations between operating company managers and the public officials that granted them their operating franchises and regulated their performance. By definition, these negotiations were location-specific: just as the American polity was decentralized, so too was the operating company's political environment. These negotiations were far more contentious, less predictable, and more potentially disruptive, than the rulings handed down by the state regulatory commissions beginning around 1907. Only after 1907 would the states begin to supplant the locality as the primary regulatory arena. In this regard, as in so many others, the telephone industry differed radically from the telegraph industry. In telegraphy, state and federal regulation had been the norm since the 1860s, and local regulation the exception; in the telephone industry, in contrast, state and federal regulation remained unusual until after 1907. In telephony, all politics was (with the important exception of patent law) local.

Operating companies such as Chicago Telephone can be termed "Bell-associated" in the sense that they were partly owned by a Bell-owned holding company--American Bell (and, after 1900, AT&T). This relationship was obvious to telephone insiders, as it is to historians today. Yet it is worth recalling that it was by not always self-evident to the general population. During a trip to Colorado in 1907 after the start of his second tenure as president of AT&T, Vail met with a banker in Denver, Colorado, who had no idea that the local telephone operating company had <u>any relationship</u> to its corporate parent, AT&T.[xxviii] This example was extreme. Yet it serves as a reminder that the telephone industry was far more heterogeneous, confusing, and

even chaotic in its formative era that is sometimes assumed. The highly variegated character of the early telephone industry is highlighted by the lack of a consistent corporate nomenclature. The vast majority of the operating companies associated with American Bell—such as, for example, the Chicago Telephone Company --did not even have the word "Bell" in their company name.

By far the most important operating companies in the 1880s were those in New York and Chicago. New York was the nation's most popular city, its financial center, and the home of the influential trade journals Electrical Review and Electrical World. Chicago was the fastest growing city in the country, the "mecca" for telephone equipment manufacturers, and the home of the influential trade journal Western Electrician.

The centrality of New York and Chicago in late nineteenth century America—and, hence, their likely centrality to the telephone industry--was evident to telephone leaders from the outset. Should the Bell patent-holders launch a successful operating company in Chicago, Vail predicted in 1878, this would secure them the control of the "whole northwest."[xxix] With the exception of New York and Chicago—one of Hubbard's business associates predicted at approximately the same time--it was not important for the patent-holders to retain a financial stake in the operating companies—since the territory of each company was geographically delimited. When the time came time to form "one great telephone company" (a common hope of early Bell leaders, and an obsession of Vail's), there would be nothing to prevent the investors from uniting the "links" and "mak[ing] the chain a unit."[xxx] "I think that Chicago is a very important point," a Chicago lawyer informed Hubbard on the same day, "perhaps the most important point in the country, and no opportunity should be lost to improve and strengthen the foothold you have already gained."[xxxi] Chicago was "really of greater importance" than even New York, Hubbard confided to Vail the following day: "With our headquarters in that city [New York] we can know everything that the

New York company does, while the Chicago company might do many things opposed to our interests of which we could know nothing until the evil was done."[xxxii]

No individual better exemplified the challenges and opportunities that operating company managers confronted in their early years than Charles N. Fay, the strong-willed general manager of the Chicago Telephone Company between 1879 and 1887.[xxxiii] Much admired by his colleagues for his forceful personality, administrative acumen, and political agility in navigating the treacherous shoals of Chicago politics, Fay minced few words in describing the challenges the fledgling industry faced. Altogether characteristic was his remarkable public assertion, in 1886, that telephone subscribers suffered from a "telephomania" that predisposed them to find fault with the telephone operating companies whose facilities they used.[xxxiv] Fay's imperiousness almost certainly cost him the presidency of the Chicago Telephone Company: he lacked the ability, as American Bell president John Hudson opined in 1887, to draw constructively on other's ideas.[xxxv] Still, his tenure as general manager provides a unique window on the operational challenges that telephone operating company managers confronted during a period of rapid, unpredictable, and often bewildering change.

* * *

The telephone, proclaimed National Telephone Exchange Association president Marshall Jewell, in his inaugural address before the association's members in September 1882, had been projected into our "social and business relations" like a "meteor": it had "seized" all branches of the commerce of this country "quicker than any enterprise, than any great principle has ever been developed in the history of human progress."[xxxvi] The invention, Jewell rhapsodized, promised

more for the "accomplishment" of human comfort and human activity than any prior invention had at its inception, "scarcely excepting steam and electricity."[xxxvii]

That Jewell offered up such an extravagant tribune to the new communications medium was in no sense surprising. As the spokesman for the nascent telephone industry, he was expected to lavish praise on the new technology, and he obliged. Having served as the chairman of the Republican National Committee during the election of 1880, Jewell knew how to work a crowd. For over fifty years, similarly situated promoters had delivered equally effusive tributes to the telegraph, the railroad, and the post office.

However bombastic, Jewell's speech did contain a kernel of truth. The telephone had become a fixture in American commerce with remarkable speed. And nowhere was the pace of change greater than in the nation's largest cities. By 1881, only 1 city with a population of more than 15,000 had yet to establish a telephone operating company, and only 9 cities with a population of more than 10,000.[xxxviii] By 1889, 400 million telephone conversations took place in the United States every year; in New York, 100,000 conversations took place every day.[xxxix] Four years later, the daily total for Chicago was 145,000—making it the busiest operating company in the world.[xl] The pace of change was especially impressive if one compared developments in the United States with those in other parts of the world. In 1888, Chicago had as many telephones as Russia; Boston as many as Holland.[xli]

To be sure, skeptics were by no means unknown. The telephone would never replace the telegraph, one magazinist declared in 1881, since speech remained dependent on human "agency," and was thus necessarily slower than machinery: "The world's business cannot move at such a pace, and the new telegraph demands machinery, not men."[xlii] Before long, declared Colorado Senator Nathaniel Hill three years later, the country would be flooded with an invention even greater than the telephone: a device that would transmit not only the spoken

word—which remained evanescent and subject to misunderstanding—but the written text.[xliii] The inventor Elisha Gray had showcased the possibilities of such a device—an ancestor of what we would today call a fax machine--during the Columbian Exposition of 1893. The commercialization of the telephone, Gray explained, had created a demand for a "better and different class of service." The coming "revolution" in the "means of communication" would be hastened by the teulotograph--a machine that, by transmitting an "exact fac-simile" of a written text, would "do what a letter does in matters of business, and can be sent as quick as a telegram."[xliv]

Gray's prediction proved to be overly optimistic: in fact, the fax machine would not become a part of the standard equipment of the business office until the 1970s. Yet the expansion of the operating companies continued unimpeded until 1888, when it was slowed for a couple of years by a technical challenge known as induction that was greatly exacerbated by the proliferation of streetcar and electric light and power lines. With the installation of two-wire (or metallic) circuits, this problem was surmounted, making it possible for the networks to spike up again, beginning (at least in New York) around 1894.

The expansion of the telephone industry in the 1880s is particularly impressive if it is compared with its closest analogue—the intra-urban (or district) telegraph. "No invention for the facilitation of communication," exulted the sober-minded editor of the Commercial and Financial Chronicle in 1885, "ever made such rapid progress. Ten years ago the very idea of using a wire for the conveyance of spoken words would have been scouted by ninety-nine out of every hundred scientific men. Six years ago the telephone was still in the stage of experiment to such an extent that most men regarded it as little more than a scientific plaything. Now it is in use in every city and large town in the country, and in every progressive city in the world…"[xlv] It was "safe to say," declared an editorialist in Electric Age in 1890, "that no other invention in the

history of the world has accomplished as much … in facilitating the transaction of the world's business."[xlvi] In an astonishingly short period, opined an editor in the Electrical Review, the telephone had earned pride of place as the "supremest invention of the nineteenth century."[xlvii]

To fully appreciate why contemporaries regarded the commercialization of the telephone as such as major event, it is important to recognize that the center of the industry in this period was to be found not in the fledgling long-distance network being built by AT&T, but the operating companies that sprang up in the nation's largest cities. This new, bottom-up perspective on telephone history was greatly facilitated in 2001 by the opening in San Antonio, Texas, of a state-of-the-art corporate archives by SBC (a former operating company). The holdings of the SBC archives complement those of the AT&T archives in Warren, New Jersey. While AT&T collected documents pertaining to long-distance telephony, research and development, and telephone manufacturing, SBC specializes in the business records of hundreds of Bell- and non-Bell associated operated companies, including the Chicago Telephone Company.

Prior to 2001, business historians interested in the early history of telephony had no choice but to rely on AT&T. Inevitably, and often unconsciously, this led them to marginalize the operating companies, and to view the early history of American telephony from the standpoint of American Bell--and, after 1900, its successor, AT&T. No matter how many boxes of documents historians scrutinized, they would never locate the director's reports or executive committee minutes of a telephone operating company (Bell or independent), since the preservation of these records had never fallen within the purview of AT&T. Though the AT&T-centric character of the resulting scholarship is understandable, it is unfortunate, incomplete, and distorting. Historical accounts based largely (and sometimes exclusively) on the AT&T archives typically say a good deal about the formation of telephone operating company policy, but little

about its implementation, and nothing about the often very different policies that these operating companies pursued. For the purposes of this essay, these accounts will be termed AT&T-centric, even if, as several were, they were highly critical of AT&T. The very decision to use AT&T as an acronym (a convention adopted, somewhat reluctantly, in this essay) runs the risk of conflating the history of the telephone industry with the activities of a single corporation. Prior to 1920, it is worth remembering, the acronym "A.T.&.T"--ordinarily with periods separating the letters, and often referred to as "the A. T. & T."--was confined largely to the financial press, and was rarely used by company leaders even for publicity purposes.[xlviii] The corporate was more generally referred to “American Telegraph and Telegraph”; its licensees as the “associated companies.”

Little is gained, and much lost, by treating the Bell-associated operating companies in the formative era of telephony as if they were part of a single, undifferentiated "Bell System."[xlix] The Bell System was never a single entity; rather, from its origins in the 1900s to its demise in 1984, it was a congeries of operating companies coupled, sometimes tightly, and sometimes loosely, to a holding company (AT&T), a long distance provider (also called AT&T), a research and development facility (known after 1925 as Bell Labs), and an equipment manufacturer (Western Electric).

Long after 1920, the Bell-associated operating companies maintained their own corporate identities, published their own magazines, designed their own advertising, built their own headquarters buildings, and even issued their own securities. Among the most architecturally significant skyscrapers of the 1920s were the New York Telephone Company headquarters building in New York City and the Pacific Telephone and Telegraph Company headquarters building in San Francisco.

Particularly misleading has been the implicit assumption that the Bell-associated operating companies were somehow less important than AT&T. In recent decades, this assumption has acquired an aura of plausibility. After all, in the 1970s and 1980s AT&T champions went to great lengths to popularize the idea that AT&T's long-distance provider had long subsidized the Bell-associated operating companies. Whether or not this subsidy actually existed was the subject of a highly technical, often acrimonious, and seemingly endless debate over what telephone insiders call "separations." Yet there can be little doubt but that, in the period before 1920, the subsidy flowed in the opposite direction--that is, from the operating companies to AT&T.

For all of these reasons, few historians have devoted much attention to the business strategy of the Bell-associated operating companies. To be sure, company histories—often lavishly illustrated—of several operating companies exist.[1] Yet relatively little attention had been devoted to operating companies in the nation's largest cities in the years prior to the expiration of Bell's patents in 1894.

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Nothing has more distorted our understanding of the formative era of American telephony than the propensity of telephone historians to assume that telephone regulation began around 1907 with the enactment of legislation putting telephone operating companies under the jurisdiction of state regulatory commissions. Politics always mattered. In myriad ways, political bodies (and, in particular, municipal political bodies) exerted a greater influence on the telephone industry in the period prior to 1907 than it would in the period after 1907. The historian of technology Thomas P. Hughes has famously posited that, in the period after 1870, a

technologically based "material constitution" has transformed American society no less profoundly than the “political constitution” had transformed the early republic.[li] In telephony, however, politics and technology were always linked. To contend as many historians do that Theodore N. Vail embraced government regulation after 1907 misses the point: Vail had no choice. The relevant issue was never whether the telephone industry would remain unregulated--for it had always been regulated--but, rather, how it would be regulated, by whom, and to what end.[lii]

In the period between 1879 and 1894, operating company managers confronted two major political challenges. The first was the acquisition and maintenance of rights of way; the second was the prevention of unfavorable rate legislation. Each of these challenges had a distinctive character, and will be considered in turn.

No telephone operating company could flourish for any period of time in a major urban center without a public franchise. Franchises enabled operating companies to navigate the oft-treacherous shoals of urban politics, and to obtain rights of way. Operating companies connected subscribers, and these connections entailed the stringing of a great deal of wire.

Beginning in the 1870s, business leaders and government officials took up the question of how and where these wires would be strung. Some recommended burying them under the city’s streets; others bunching them together in aerial cables. Each had its detractors. “I am quite confident,” declared Western Union president William Orton in 1878, that “when the public understands how much greater will the nuisance of underground wires than the present pole and wire plan, there will be a much more earnest protest against the occupation of the streets with trenches than there has been against even the largest poles.”[liii]

One of the first public discussions of what critics would come to call the “overhead wire menace” took place in Chicago in 1875. Overhead wires, a city council report concluded,

threatened the integrity of the fire alarm apparatus that the city had installed following the Chicago fire of 1871.[liv] The catalyst was the rapid commercialization of district telegraph companies that provided subscribers market quotations (by means of a device known as a ticker). Further problems were anticipated with the imminent commercialization of the telephone—which was expected to expand at an even more rapid pce.[lv] Initially, aldermen contemplated putting the fire alarm wires underground. After calculating the cost, however, they decided to require the proprietors of all other wire networks to bury their wires instead.[lvi]

The first underground wire ordinance in a major American city was enacted by the Chicago City Council in May 1881. The law required every company that had strung electrical wires in the streets of Chicago—which, by this time, included the Chicago Telephone Company—to bury them by May 1883.[lvii] Later that year, a New York jury declared certain telephone poles that Metropolitan had erected a nuisance, opening the company to lawsuits under the common law.[lviii] In June 1884, the New York state legislature enacted a comprehensive underground wire law. This law established a timetable for the burial of the overhead wires of every telegraph, telephone, and electric light company in the state that operated franchises in cities with a population larger than 500,000—that is, New York and Brooklyn.[4]

Operating company managers reacted to underground wire legislation with undisguised alarm. The Chicago underground wire ordinance, warned Morris F. Tyler in September 1882, was the "severest attack" by a government agency that the telephone companies had yet to confront. Tyler assumed that the law would be declared void—since he took it for granted that its provisions could not possibly be met. It was an "elementary principle," Tyler explained, that the enactment of a law that required the "doing of something which is physically impossible is void."[lix] If the operating companies could demonstrate that by burying the wires "the business will be buried with them," the law would have no practical effect.[lx]

American Bell electrician Thomas D. Lockwood challenged the presumption that the movement to bury the wires was "truly" popular. It was, he believed, rather the work of "special interests"—including, in particular, the "professional inventors" who stood to benefit from keeping the nation's thoroughfares in a state of "volcanic convulsion."[lxi] Others blamed the legislation on the owners of franchises for underground conduits. "Not even the scheming band of monopolists who own a right to build subways," sputtered one trade press editor in 1884, "can force the telephone wires underground" in the absence of solid evidence that such a project was technically feasible and economically sound.[lxii]

The plausibility of such quasi-conspiratorial theories was greatly enhanced by the realization that, in Chicago, Western Electric engineers Enos Barton and Milo Kellogg had publicly lobbied the city council to bury the wires. In their "anxiety" to sell cables to the telephone company—Chicago Telephone Company president Norman Williams explained to the company's largest stockholder, Theodore N. Vail, in 1883--Barton and Kellogg did not hesitate to "advocate" the adoption of underground cables. Williams conceded that Western Electric's attempt to secure contracts for underground cables to be "entirely proper" in a "business way." Yet he warned that it might prove disastrous for the Chicago Telephone Company. Might not, Williams implored, Vail undertake some "missionary work" with Barton and Kellogg? Barton and Kellogg, after all, were principals in a company that was supposed to be cooperating with American Bell, and in which American Bell owned a substantial portion of stock. Might not Barton and Kellogg be encouraged to be more discrete in their future public statements about the "practicality" of these cables—and, in particular, their suitability for telephone service over long distances (a fact that had yet to be established): "The slightest comfort in the way of the use of these cables will be seized upon by the city, and by the newspapers, and therefore it becomes necessary to be very careful in their statements to the public."[lxiii]

Many telephone leaders—including Vail—doubted the technical feasibility of underground cables for telephone service (particularly for long distances) as late as 1885.[lxiv] Once governmental bodies began to require that the wires go underground, however, telephone companies quickly devised methods to comply with the law. Telephone managers simply had no alternative, American Bell electrician Thomas D. Lockwood informed the NTEA in 1884, to bury quickly and economically every telephone wire that crisscrossed the central business districts in the nation's major cities.[lxv] In Chicago, the burying of the underground wires was overseen by Charles N. Fay; in New York, by Vail. (Fay initially relied on injunctions to prevent the city council from interfering with the company's property; almost immediately, however, he concluded that it would be more prudent to comply with the law.) Typically, operating company officials worked out a compromise with government officials that led to the burial of the wires only in the most densely settled portions of the city. Even so, the role of government regulation in fostering innovation was impressive—and fully bore out Alexander Graham Bell's prediction that only political fiat could force the wires underground.

The burying of the telephone wires eliminated one of the most visible points of contention between city dwellers and the urban telephone operating company. Out of sight, out of mind: the telephone company somehow seemed less formidable when its presence was not longer trumpeted by a tangle of wires on every major thoroughfare. Its benefits were by no means merely aesthetic: Underground wires were less expensive to maintain and less likely to embroil the company in lawsuits.

No issue perplexed operating company managers more than the pricing of telephone service. Initially, Bell licensees set rates low to compete with Western Union, which had rapidly begun to establish its own telephone operating companies in 1878. This competitive interlude ended in November 1879, when Western Union agreed with the Boston investors who controlled

the Bell patents to divide the market. Henceforth, the Bell licensees would focus on telephony and Western Union on telephony.

Western Union's willingness to abandon the telephone has long intrigued business historians, who have often called it the worst business decision in history. How can it be explained? Western Union managers had good reason to focus on its core business of long-distance telegraphy.[lxvi] In addition, they had proved unsuccessful in at least one attempt to buy out Bell, and, in 1879, feared a competitive assault on their core business by the financier Jay Gould.[lxvii] Nothing concerned Western Union managers more than the possibility that Gould might somehow combine with the Bell interests to establish a joint telegraph-telephone empire. Western Union managers recognized that they were extremely unpopular, and that any attempt to absorb the Bell interests might well spur federal legislation aimed at reigning in their power. "Causes outside the strength of our patents" strengthened the Bell patent holders in their contest with Western Union, Forbes informed Bell patent lawyer James Storrow in 1880. "The presence of Gould in the field," as well as "the existence of a considerable public opinion against Western Union" were "without question" important factors that "added much to the anxiety of that company for a settlement."[lxviii]

Everyone understood that a prolonged legal struggle would have been disastrous. "Separation of interests," Bell observed in June 1876, in reporting on a recent conversation with rival inventor Elisha Gray, "will lead to protracted lawsuits and the ultimate result will be that Western Union can step in and buy up whatever party they choose."[lxix] Should there be a prolonged legal struggle, Western Union president William Orton warned in 1878, the commercial introduction of the telephone would be seriously retarded, "whatever" the result: "The first effect of competition will be reduction of rates and increase of expense. A protracted fight will destroy the value of all interests."[lxx] Investments in "all these patent things"—

including the telephone—involved, William Forbes's father John Murray Forbes declared in 1880, "too much 'good will and hard work'"—though he was quick to add that he was pleased when "bolder" investors got "sugar plums out of them."[lxxi]

In a sense, the strong legal position of Bell's patents that AT&T triumphalists often pointed to in explaining why it prevailed was a consequence of the timidity with which Western Union challenged them in court. Everyone remembered how contentious the struggle over Morse's telegraph patents had been (George Gifford, Western Union's patent lawyer, had participated in the earlier litigation) and no one wanted a repeat of that debacle.

This competitive interlude gave the nascent telephone industry a powerful boost. "It became," as Lockwood reminisced in 1887, "a means for spreading the use of the telephone widely over the land, for the wide establishment of the telephone exchange, and for accustoming the public to the frequent use of the telephone, which no other agency could probably have equaled."[lxxii] Yet it posed major challenges for operating company managers. The "peculiar and unfortunate conditions" under which telephone service had been established—or so explained Hall in 1881—and in particular the sharp competition between Bell and Western Union, had rendered the vast majority of operating companies unprofitable, and had left little time for "deliberation or study" with regard to the rates.[lxxiii]

The combination of the Bell and Western Union operating companies in November 1879 confronted operating company managers with the challenge of persuading subscribers (as telephone users were then called) that they should pay more for access to the now-enlarged network. This was counterintuitive, since it was widely assumed that, if a telephone company were capably managed, it would—like a wholesaler—lower its costs and pass on the difference to its customers. What economists would later call "economies of scale" was a maxim of trade, and it seemed inconceivable that it did not apply to the telephone industry. Only slowly would

contemporaries find themselves persuaded that in the telephone industry, unlike most other businesses, costs actually increased as output (that is, telephone service) expanded. Operating company managers, as Hall explained, had learned from "bitter experience," that costs per subscriber necessarily increased as the company's network expanded--a relationship he predicted, that the average subscriber would find "incomprehensible."[lxxiv]

Industry spokesmen missed few opportunities to underscore this discovery in their public pronouncements to the press. Yet, just as Hall had predicted, subscribers remained skeptical, as did the press. The idea that telephone rates should increase as the size of the network expanded was ridiculed by an editorialist in the New York Times as late as August 1901.[lxxv] For New York lawyer Simon Sterne, it was nothing short of preposterous. To drive his point home, Sterne made an analogy between telephone service and urban sociability. Just because he might—should he so choose--greet everyone he met on the street, Sterne reasoned, he saw no reason why he should be dunned to reach them all by telephone. Telephone subscribers such as himself were far too busy to use the telephone as a social medium: instead, they confined their telephone use to their business or social relations, and could not understand why the telephone company had the presumption to charge them for the privilege of talking with people with whom they had no desire to converse.[lxxvi]

Most operating companies charged a fixed fee for the unlimited use of the telephone for a particular interval. Subscribers had the right to use any telephone within the operating company's network (in addition, of course, to their own). To prove that they were, in fact, subscribers, the operating company issued them special printed cards. Several of these cards—issued by the Chicago Telephone Company in the 1880s--survive in the SBC Archive in San Antonio, Texas.[lxxvii] Should a telephone subscriber wish to use a public telephone, he had the right to do so without paying a fee.

The presumption that unlimited access to telephone service was transferable from telephone to telephone may well seem curious today. Yet it was only gradually abandoned. In 1894, for example, Milwaukee druggists sued the Milwaukee Telephone Company to uphold the right of telephone subscribers to use public telephones free of charge.[lxxviii] This presumption died a lingering death: As late as 1902, it was taken-for-granted by an editorialist in the Electrical World.[lxxix]

Non-subscribers were not supposed to use a subscribers' telephone—an abuse known as "dead heading" (a phrase borrowed from railroading). "The use of subscribers' telephones by transient customers"—explained the subscribers list of the Metropolitan Telephone Company for 1884—"is a violation of the contract and a detriment to business."[lxxx] In practice, however, this prohibition proved impossible to enforce, since subscribers saw little reason not to oblige a neighbor or friend. (Since telephone subscribers paid a flat fee, dead-heading did not increase the size of their bill.)

Flat rates—as this pricing scheme came to be known--had several advantages. It was simple, fostered widespread experimentation with a new and unfamiliar medium, and was easy to administer: the only metering device one needed was a calendar. For most operating companies, this pricing scheme worked reasonably well and would long remain the norm for local service. Indeed, it remains common today.

For the relatively small number of operating companies located in the nation's largest cities, however, flat rates quickly came to pose a major operational challenge. Certain subscribers—lumberman, commission merchants, and bankers—used their telephone almost continuously, clogging circuits and increasing switching costs. Others resented the high rates the company charged. For still others (probably the largest number of all) flat rates discouraged them from using the telephone at all.

Operating company managers struggled—with varying degrees of success—to resolve the challenge that flat rates posed. This conundrum was far more pressing than the technical challenges posed by long distance telephony. For the vast majority of telephone users, the relevant spatial unit was not the region (let alone the nation) but the locality. Far from being a seamless web, the telephone industry in its formative era was a patchwork quilt. A relatively small number of merchants, manufacturers, and financiers sought--and were willing to pay for--inter-city and (beginning in 1885) even inter-regional service. The vast majority merely wished to summon a doctor, order food from the grocer, or chat with family and friends across town. For them, local telephone service was the only kind of telephone service that they knew or desired. To call someone in another city--let alone in another state--was a rare and memorable event. For the vast majority of Americans, this would remain true until after the Second World War.

Just as telephone service was local, so was telephone regulation. From the beginning, telephone companies operated in an extraordinarily dense and at times bewilderingly complex regulatory environment. In this environment, telephone managers found themselves locked in a perpetual struggle with government officials, trade associations, and user groups. Competition in telephony was always contrived: contrary to what seems to be the widespread impression among industry boosters and detractors alike, at no time in its early history did unfettered competition prevail. From the outset, the success or failure of telephone operating companies hinged on the ability of telephone managers to obtain favorable charters and to forestall the enactment of hostile legislation (at both the local and state level). Few industries have been more profoundly shaped by political fiat. Fewer still have been more skillful at concealing the extent to which they were creatures not merely of technology and economics but also of politics and culture.

The development of telephony in the twentieth century has obscured the extent to which it remained in its formative era localistic in the dual sense that it provided a local service and was subordinate to local regulation. It is so common today to call a friend or relative in another country--or to send an email message around the world--that it is easy to forget how unusual such a practice would have seemed a century ago. It is impossible to exaggerate the importance of recognizing the distinction between the theoretical ability to take a certain action (such as calling long distance) and the likelihood that such an action would in fact be performed. Notwithstanding the best efforts of telephone industry publicists, there is little evidence that more than a tiny percentage of Americans in the late nineteenth century evinced the slightest desire to make a long-distance telephone call. If they wished to reach out and touch someone (as a later telephone advertising campaign proposed) they always had the option of sending a telegram or mailing a letter. The primary—and, indeed, the only--competitor of the telephone, as one industry insider explained in 1884, was the "small boy" that employers relied on to run errands. The wages of a small boy amounted to about $3 a week; if an employee could not afford $1 a week for telephone service, he was best advised not to subscribe.[lxxxi]

No operating company manager devoted more attention to the rate question (as the pricing of telephone service would come to be known) than Edward J. Hall, Jr., the manager of the Bell-licensee in Buffalo, New York. As early as 1880, Hall predicted that telephone usage in operating companies located in large urban centers would expand if operating company managers could charge by the call, rather than by the year. Hall's pricing scheme—initially dubbed the "Buffalo system" and later known as measured service--possessed, Hall believed, an "element of fairness"—in contradiction to flat rates, which he (correctly) recognized to be purely arbitrary.[lxxxii] The basic rate was 10 cents a call, with a minimum of 500 call a year.[lxxxiii]

Measured service was staunchly resisted by many if not most telephone users, and would be successfully introduced before 1894 in a relatively small number of cities, including Buffalo and San Francisco.[lxxxiv] Yet it was no means illogical. If operating companies continued to charge flat rates—or so Hall predicted in 1880--they would find it necessary, over time, to increase their rates to such a "stiff" price that the number of subscribers would be greatly reduced.[lxxxv] Measured service, in contrast, encouraged users to make their own regulations as to how the new medium should be used. Groups of individuals might "club together" to install a telephone, which they could then rent out to anyone who might happen to be in the vicinity: "One man or five or ten men can use the telephone together; any man could come in off the street and use it; the more the better."[lxxxvi] Hall recognized that measured service would decrease the number of calls made by heavy users, since they would now have an incentive to discourage frivolous calls. (The primary offenders were, if the accounts in the trade press can be believed, young male office clerks with an insatiable appetite for baseball trivia and the latest sporting news.) Yet he was convinced that it would increase the number of calls made by occasional users—and would thus be a net social benefit: "Our interest is first the interest of the public, to make everything open and free, if it is paid for, and to use as much as possible, to work with [the users] instead of against them."[lxxxvii]

Hall recognized that measured service was a hard sell for those telephone users who had become accustomed to flat rates. Yet he remained convinced that the "true system" was to "get money for every service and in proportion to the service."[lxxxviii] Operating company managers, as he saw it, had two options: They could charge a high flat rate and furnish unlimited service, or a small rental fee and charge per message—"so as to bring the telephone into more general use."[lxxxix] Hall preferred the latter. After all, under his plan, "the interest of the company is to have the machines used as much as possible; the subscriber's interest to limit the use." At

present the incentives ran in the opposite direction—the operating company had an incentive to restrict usage, while the subscribers did not.[xc]

By no means the least important advantage of measured service was its effectiveness in preventing the unauthorized use of telephones by non-subscribers. "Dead heading," Hall estimated in 1886, made up between 25 percent and 35 percent of all the telephone calls made through operating companies that remained on flat rates. In addition to eliminating dead heading, measured service would create business opportunities for existing subscribers. Were a merchant to hang outside his store a sign that proclaimed that he had a "Public Telephone," Hall predicted, he would soon find himself making a little money on the side. Non-subscribers, or so Hall assumed, would gladly pay storekeepers a small fee to use their telephone; storekeepers, for their part, would share this fee with the telephone company. In Buffalo, Hall observed, some business subscribers had in this way made a "clear profit" of between $50 and $100 a year.[xci]

To popularize measured service Hall tried a variety of expedients. To encourage new users, he issued prepaid tickets (somewhat like today's phone cards) that storekeepers could redeem at the telephone company for credit. Tickets, exulted one industry watcher in 1885, would solve the "Telephone Dead Head Evil" even as they increased popular awareness of telephony as a "great convenience." There was nothing, of course, to prevent storekeepers from charging non-subscribers for the use of their telephone; so long, however, as subscribers paid a fixed annual fee, these occasional users were "not apt to pay except with thanks."[xcii]

However beneficial measured service might be for telephone users (subscribers and non-subscribers alike), it imposed a novel burden on the operating company. Henceforth, after all, someone who would have to keep track of the number of calls every subscriber made. (No one envisioned measuring the length of a telephone call: and, in fact, no device for measuring the length of a local telephone call was devised until after 1920.) Yet Hall remained unfazed.

District telegraph companies, he observed, had long maintained a "post office system of boxes" in which employees deposited a ticket every time a subscriber required that a task be performed. Telephone operating companies could follow their example. "If you have been in a post office and seen them distribute letters you will be able to imagine how rapidly an operator will distribute these tickets after becoming accustomed to it."[xciii]

The additional record-keeping that Hall's proposal entailed prompted a sharp rejoinder from George F. Durant, the vice president of the Bell Company of St. Louis. Such a scheme, Durant complained, would be a "nightmare" to implement. In his office, Durant boasted, we have done away with paper: "we don't keep a record of anything."[xciv] What was wrong, Durant asked rhetorically, with simply raising the rates? To make his point, he recounted a recent conversation that he had had with a subscriber. The St. Louis network, his subscriber declared, was becoming too large—making it harder to get on-line (since the operators had more connections to make) and to reach a particular subscriber (since the line was more likely to be already in use). Would it not be better, the subscriber concluded, for the company to keep the size of its network small—and the quality of the service it provided high--by raising its rates to, say, $120 a year.[xcv]

Measured service had one indisputable advantage over flat rates. So long as operating companies charged a single monthly fee, subscribers had an obvious rallying cry: keep the rate low. Measured service, in contrast, discouraged political mobilization by dividing users into rival camps. Or, at Hall pithily put it, "it spoilt the unanimity with which they [telephone users] combined against any attempt to raise the rates."[xcvi]

The prospect that telephone subscribers might join together to oppose a rate increase—or, even more disturbingly, that they might lobby for a rate decrease—was for operating company managers a constant cause of concern.[xcvii] Telephone subscribers lobbied state and local

government officials almost constantly to regulate the rates that telephone companies charged, and, in one celebrated instance, secured a legislative coup. In 1884, the Indiana legislature enacted a maximum rate schedule for telephone operating companies operating within the state. The Indiana Bell licensee—the Central Union Telephone Company—appealed the ruling to the Indiana Supreme Court, to no avail. (The law was illegal, the Bell licensee contended, since their business had been made possible by federally guaranteed patent rights with which the state of Indiana had no right to interfere.) [xcviii]

The Indiana rate law had a markedly deleterious effect on telephone service in Indiana. Were the law to be sustained in the courts, one operating company manager predicted, telephone service in Indiana would be "seriously crippled" and in many places the use of the telephone "absolutely prohibited."[xcix] Following the court ruling, this prediction became a self-fulfilling prophecy. The executive committee of the Central Union voted unanimously to authorize its president to close every exchange in Indiana that could not shifted over to measured service.[c]

In short order, Central Union—the Bell licensee—closed 5 of its 39 exchanges, and switched the remainder over to measured service.[ci] Within the next few years, fully two-thirds of the telephone exchanges in the state were shut down—including almost every exchange in the southern part of the state--as well as half of all the telephones.[cii] When 500 subscribers in Indianapolis banded together and refused to pay the new rates, company officials threatened to physically remove the telephones of the "striking subscribers."[ciii]

Company officials routinely characterized the subscribers' protest as a "strike." Though this phase is usually presumed to refer exclusively to conflicts between management and labor, in the 1880s it was freely used to also refer not only to consumer boycotts (such as telephone user strikes), but also to hostile legislation.[civ] (That is, not only an employee, but also a consumer, and even a politician, could "strike" a corporation.)

For the Indianapolis telephone subscribers, politics and economics merged. It was a "common expression," among the strikers, as one operating manager observed, that "they had no complaint whatever to make as to the service, and that the telephone was well worth what it cost them, but that they were fighting for what they felt they were legally entitled to."[cv] Yet the outcome was the same: less revenue for the telephone company, and a sharp reduction in the level of service.

Operating company managers lost few opportunities to underscore that the Indiana rate law had proved "disastrous" to the telephone business in Indiana—and predicted that it would serve as warning to other legislatures not to meddle with their prerogatives.[cvi] Fay went so far as to urge telephone operating companies to publicize all such legislative assaults in order to discourage their recurrence. Fay's report met with the predictable rejoinder that such publicity would only encourage still further legislative assaults. In this period, most operating companies following the example of American Bell (which was well known for its "golden silence") and rarely commented publicity in the press on current events.[cvii] The only operating companies to publish annual reports were the New England Telephone Company, the Southern New England Telephone Company, and the New York and New Jersey Telephone Company. The Chicago Telephone Company would not publish its first annual report until 1899.

Operating company managers reacted to the prospect of rate legislation with anger and alarm. Maximum rate bills, Fay sputtered, were invariably the work of extortionists—the "worst class" of our population—who floated them in the hope that telephone company officials might find it to their advantage to buy then off.[cviii] Honest legislators, Fay reported, could help the company to fend off such attacks. Yet not all legislators were honest. To meet any possible contingency, his company kept close tabs on pending legislation in Springfield (the state capital), and spent large sums on lobbyists to fend off legislative assaults on its prerogatives.[cix] Fay's

conviction that extortionists intent on blackmailing telephone companies freely plied their trade in state capitals was widely shared. Indeed, the practice was so common that it came to be known as "sandbagging." Even editors hostile to the Bell licensees deplored the practice and hoped that something might be done to prevent its recurrence. [cx]

Sandbagging may well have been notorious, yet it could and did sometimes succeed. In 1888, for example, the Chicago city council obliged the Chicago Telephone Company to accept a new franchise that placed a ceiling on flat rate service following a long struggle during which the city council had denied the company the permits it required to maintain telephone service for subscribers that had changed their address.[cxi]

Fay's consternation was exacerbated by the likelihood that other states might emulate the example that Indiana had set. And nowhere was the danger greater than in the state of New York, the home of two of the country's largest telephone operating companies: Metropolitan in New York (or what we would today call Manhattan), and New York and New Jersey in Brooklyn. In almost every annual session of the New York state legislature between 1888 and 1894, telephone user groups lobbied for a maximum rate law. None succeeded. Yet the agitation sparked a major legislative investigation, generated a good deal of publicity, and enlisted the support of dozens of business groups that included the New York Board of Trade and Transportation, a venerable New York-based trade association whose leaders included the respected lawyer Simon Sterne.[cxii]

Nothing made more likely the prospect of hostile legislation than the threat of a telephone users' boycott. One of the first user boycotts took place in Washington. D. C. in 1881—in response to the abortive attempt of operating company managers to emulate Hall's example in Buffalo and substitute measured service for flat rates.[cxiii] By far the most notorious took place five years later, in Rochester, New York.

In the fifteen-month period between November 1886 and March 1888, Rochester telephone subscribers staged an ultimately successful boycott of the telephone company that was unprecedented in the annals of telephone history. The "telephone war," as it was dubbed in the press, was unique: nothing like it had ever happened before, and nothing like it would happen again.[cxiv] Of the city's 900-odd telephone subscribers, over 800 signed a pledge to “hang up” their telephone.[cxv] Almost no one violated the pledge, rendering telephone service—as one editor recounted shortly after the boycott had ended-- "practically useless" for over a year.[cxvi] Please rid my house of your telephone, one irate subscribers implored a company official shortly after the strike had begun: everything connected with the company was “undesirable and an eye-sore”: “Get out of town as soon as you possibly can, and give us a rest.”[cxvii]

The catalyst for the boycott was the decision of Hall’s Bell Telephone Company of Buffalo (the company’s territory embraced Rochester) to require Rochester telephone users to switch from flat rates to measured service. This was bound to prove controversial: telephone subscribers throughout the country preferred flat rates and Rochester's were no exception.

The imposition of measured service was but one of several grievances that Rochester telephone users had with the company. In addition, they resented the peremptory manner in which it had strung hundreds of miles of overhead wire along Rochester's streets, which they considered not only ugly but dangerous. Though telephone lines relied on low voltage, they could easily become entangled with electric power lines, which did not. Downed telephone lines were, thus, a potentially deadly hazard. Newspapers frequently ran stories of urbanites being injured—and, in some cases, even electrocuted--by downed electric lines. In one celebrated lawsuit, Hall’s company was held liable in the death of a Buffalo man electrocuted by a downed wire, which, in the opinion of a juror, were "secret and deadly traps to human life."[cxviii]

While measured service and overhead wires were the Rochester telephone users' major grievance, other—more purely local—considerations figured in the protest as well. Rochester residents enormously resented the fact that their telephone company was headquartered not in Rochester, but in Buffalo. How could this be, they wondered, in a city that had given birth to Western Union? What was to prevent the merchants of Rochester, one local telephone enthusiast proclaimed, from once again establishing a communications empire of "national importance"[cxix]?

The enthusiast's challenge received a major boost from the Rochester city council, which blocked the Bell-associated operating company from enrolling new subscribers, and hinted that it might even take the even more radical step of tearing down its wires. "There was a strong popular impression," Hall explained to American Bell president John Hudson, that the Rochester company had no "legal rights."[cxx] Emboldened by the Indiana rate law, the city council hoped to stir up enough an excitement to secure something similar in New York. [cxxi]

Lurking behind these issues was a cultural divide. Measured service represented, in the minds of Rochester subscribers, an unwarranted intrusion by the telephone company into the patriarchal household. So long as flat rates prevailed, strike leader John Van Voorhis explained to a local reporter, he saw nothing wrong with permitting his children to use his telephone to call their friends. Yet if he had to pay 10 cents for every outgoing call, he would stop this practice immediately. "I am glad to accommodate my neighbor in this as in any other way," Voorhis declared, "and it is none of the company's business."[cxxii] Voorhis's standoff with Hall highlights the cultural divide between Hall as the manager of a public network and Voorhis as a network user who resented the company's interference with what he presumed to be his personal affairs.

As the strike dragged on, rival telephone promoters looked to Rochester as a promising market. Among them was Sylvanus Cushman: a maverick inventor who claimed to have invented a telephone prior to Bell.[cxxiii] (Since U. S. patent law recognized the priority of the

invention—as opposed to the priority of the patent—Cushman's claim, if sustained by the courts, would have deprived American Bell of its principal asset.) Cushman never did establish a telephone operating company in Rochester; he did, however, set up a number of exchanges in Indiana (mostly in towns that Central Union had vacated following the Indiana rate law). Predictably, Cushman soon found himself in court as the defendant in a patent infringement suit and, in 1888, was forced to close up shop.[cxxiv]

One Rochester newspaper editor blamed the strike on Hall. Had Hall been less stubborn, the editor predicted, the controversy would have been swiftly resolved. To break the impasse, President Forbes called on David Bigelow Parker—a well-respected public figure familiar with the peculiar dynamics of upstate New York politics (he hailed from nearby Chatauqua County) who had worked for Bell since 1883.

It was an inspired decision. Prior to his appointment at American Bell, Parker had had a long and distinguished career in the Post Office Department—where he had distinguished himself as a capable administrator with a gift for public relations.[cxxv] Parker charmed everyone he met in Rochester and successfully negotiated an end to the strike.[cxxvi] (Parker dropped Hall's insistence on measured service, and persuaded its executive committee to appoint at least one Rochester resident to its board.) Though this outcome constituted as setback for measured service, it was greeted by Metropolitan Telephone president Theodore N. Vail with enormous relief, since it eliminated an irritant that might well eventuate in unfavorable legislation in Albany. Vail found it particularly unhelpful that American Bell officials had charged Cushman's backers with patent infringement. By arrogantly flaunting their legal prerogatives in this way, they had "created an excitement" that inflamed public opinion and was understandably viewed by the striking subscribers as a breach of the "truce that was pending."[cxxvii]

Though the Rochester strike did not culminate in the kind of hostile legislation that Vail had feared, it appears to have shaped the recommendations of one of the first major investigations of telephone service. In 1888, the New York state legislature appointed a committee to investigate telephone service in New York. This committee—which met while the Rochester strike was still underway—eventually issued a report that recommended both a state-mandated maximum rate law (something the Rochester strikers very much desired) as well as a gradual switchover to measured service (Hall's goal). While the state legislature never enacted the proposed rate law, its endorsement of measured service pointed the way to the future.[cxxviii] Measured service may have been abandoned in Rochester, yet within a decade it would be introduced in most of the leading commercial centers of the country. The fact that Rochester merchants had so bitterly opposed it was, in the end, a testament to their provinciality.[cxxix]

The barrage of hostile telephone legislation troubled many telephone leaders, including American Bell president William L. Forbes. In 1884, a Massachusetts-based telephone users group known as the "Telephone Subscriber's Association" urged the state legislature to regulate--a "polite way," as one editor put it, "of saying 'reduce'"—telephone rates throughout the state.[cxxx] The "constant interference" of state legislators in the company's affairs, Forbes confided to the prominent banker Henry L. Higginson in 1886, in conjunction with a threatened court challenge to Bell's patents, prompted him to seriously contemplate selling his (small) holdings in the New England operating company.[cxxxi]

Forbes found the possibility that the Supreme Court might invalidate Bell's patents particularly disturbing—it "worried me out of all reason," or so he informed Higginson. Forbes found equally troubling the prospect of hostile state legislation. That legislators would attack in this way a corporation that had proved so lucrative for its investors struck Forbes as the height of folly. After all, in this period, the vast majority of American Bell stockholders lived—like

Forbes—in Massachusetts.[cxxxii] Forbes regarded himself as a savior of the industry, and castigated the legislature for its failure to appreciate its inherent dynamism. "I do not believe," Forbes wrote Higginson, that it was generally known that, had Western Union been unopposed in 1878—as it had been opposed by all—it would have throttled the nascent telephone industry as an interference with the telegraph, and then "we should had had no telephone worthy of the name."[cxxxiii]

In the year preceding the Rochester telephone strike, NTEA president Charles N. Fay reflected in his annual address on the challenges that telephone operating company managers confronted. The recent prosecution of the agitators who (or so Fay believed) had instigated the Haymarket bombing in Chicago, had, Fay affirmed, thankfully marked the "triumph of law over Anarchy and Socialism." Now that this crisis had passed, business was sure to improve.[cxxxiv] This was true even though state and local government officials continued to push for legislation requiring telephone operating companies to limit their rates and bury their wires, while federal officials (led by the attorney general) attacked Bell's patents in the courts. It was "unquestionable," Fay conceded, that a "wave of popular hostility"—a veritable "telephomania"—was sweeping the country.[cxxxv]

Why, Fay wondered, had the telephone industry become the object of such an unrelenting attack? Part of the explanation, Fay suspected, lay in the unique vulnerability of telephone companies to extortion—possessing, as they did, an expensive and immovable physical plant. No matter what the government did, the Chicago Telephone Company could not very well move to Milwaukee. "Everywhere localized," Forbes lamented, telephone companies were the "most visible and tangible" of the "monopolies."[cxxxvi] That they had proved to be profitable only made matters worse. Though there were no "telephone millionaires" to compare with the telegraph magnates Vanderbilt and Gould, certain individuals (Fay might have named himself, but he did

not), had figured out how to make the new medium pay.[cxxxvii] And riches were almost invariably a cause of resentment. Even so, Fay observed, he remained perplexed as to why—in an age in which every corporation was suspect--the telephone industry should have occasioned such widespread concern. After all, in the "nature of things" the "great mass of the people" had "nothing whatever" to do with it.[cxxxviii] The 160,000 telephones that operating company managers had installed provided facilities for no more than one-quarter of one percent of the general population.[cxxxix] And nothing that he or anyone else did could do could significantly expand the size of the network. "In our wildest dreams," Fay predicted, "we cannot hope" to reach more than "one-half of one percent" of the general population--a "minute fraction" that was "most emphatically, in every way, shape and manner, composed of the rich capitalist class." And the wealthy, or so Fay assumed, were eminently able to pay whatever fees the company might propose.[cxl]

That the telephone might one day become a genuinely popular medium was for Fay incomprehensible. Fay's convictions on this score were so widely at variance with the enthusiastic pronouncements of telephone pioneers such as Alexander Graham Bell that they are worth quoting at length:

> Telephone users are men whose business is so extended and whose time is so valuable as to demand rapid and universal local communication. A laborer who goes to work with his dinner basket has no occasion to telephone home that he will be late to dinner; the small householder, whose grocer lives just around corner, would not pay one cent for a telephone wherewith to reach him; the villager, whose deliberate pace is never hurried, will walk every time the few steps necessary to see his neighbor in order to save a nickel. The telephone, like the telegraph, post-office and the railroad, is only upon extraordinary occasions used or needed by the poor. It is demanded, and daily depended upon, and should be liberally paid for by the capitalist, mercantile and manufacturing classes. This talk about oppressing <u>the people</u> is the merest rot. It is very true that every man would like to have a telephone if he could get one for nothing, but so would every man like to have horses and carriages, and good things to eat and drink and wear if he could get them for nothing; and the latter would be far more appreciated by the poor man than the telephone. If, therefore, the State must interfere to furnish

luxuries cheap to all men, it had better begin with those things which would be most universally welcome."[cxli]

Fay elaborated on the shortcomings of the average telephone subscriber in even greater detail the following year, in what was to be his final address as president of the NTEA. The Rochester telephone strike had yet to be resolved, and it was very much on Fay's mind. No public address by a telephone leader in the nineteenth century set forth with greater candor the premises that informed the thinking of operating company managers in the formative era of the industry. Fay's address was so forthright that trade press editors declined to reprint it; it was also silently omitted from certain copies of the NTEA's published proceedings—including the set at AT&T.

The "unpopularity" of telephone operating companies, Fay warned his colleagues, was their "most conspicuous weakness." That nine men out of ten in every community were antagonistic to its telephone company was a "serious menace" to our "very existence." The unpopularity of the telephone company had a variety of consequences: most obviously, it created a climate that made likely unfavorable legislation, administrative rulings, and court decisions. In addition, it fostered the "vague feeling" that operating company franchises should be given over to a "vast third party called the State"—a sentiment that Fay derided as "un-American, unnatural, and nothing short of socialism pure and simple."[cxlii] The pervasiveness of this hostility was an "extraordinary phenomenon"—how could it be explained? How, that is, could a harmless, innocent, and useful service that was patronized by only a tiny fraction of the general population come to be "obnoxious to the masses"?

The answer lay in the poisonous ideas that had been popularized by telephone subscribers. Telephone subscribers, Fay warned, might fancy themselves "conservative men of property." In reality, however, they were "socialists" who, like the Knights of Labor, resorted to

strikes and boycotts to achieve their dubious goals. To add insult to injury, the strikers were among the wealthiest element in the community. "The telephone is peculiar"—Fay declared, returning to a theme that he had elaborated in he previous year—in that it was "patronized almost entirely by the plutocrats of the country; its merchants, bankers, professional men, managers of great corporations, and the like; in a word, by the richest, best educated and most conservative class, limited to about one-half of one percent of the population. "[cxliii]

Prior to Haymarket, Fay explained, most Americans (whether they knew it or not) were socialists in the sense that they resented the enormous fortunes amassed by such men as Astor, Vanderbilt, and Gould. This resentment translated into a spate of anti-business legislation (including legislation to tax corporations unfairly) and encouraged labor groups such as the Knights to flex their muscles—a situation that culminated in Haymarket.

Following Haymarket, the Knights of Labor had come, thankfully, to realize that they could not "override" the "laws of trade and human nature." Telephone subscribers, unfortunately, had yet to learn their lesson. As a consequence, telephone companies continued to find themselves exposed to "direct and concentrated popular attack" to "a degree hitherto unknown and impossible among other monopolies." It was the obligation of operating company managers to meet this attack on the "broadest and highest ground."[cxliv] They must stand on the ground of "public welfare"—and not mere "pecuniary interest."[cxlv] They must show even our "most enlightened citizens" that there is an "ignorant, vicious, unreasoning Knight of Labor" under the mask of the "brilliant editor" or the "conservative financier." A "great and intelligent people" cannot be at "war" with its productive industries—the "very means and basis of existence." Corporations—no less than "great capitalists"--had "transcendent powers for good": they should not "always" be regarded as the "natural enemies of the people."[cxlvi] Organization and education were the order of the day: the poor will learn the "inestimable value" of riches; the

rich his “responsibility to the poor”; and the “sorrowing patrons” of the telephone company (should the strikers prove successful) would write its epitaph: “Here lies the telephone, the greatest and most benevolent of all the Monopolies.”[cxlvii]

Soon after Fay left the Chicago Telephone Company, his predictions very nearly came true. In February 1888, the Chicago City Council prohibited the Chicago Telephone Company from stringing any additional telephone wires in the city (either overhead or underground).[cxlviii] This ban prevented the company not only from soliciting new business, but also from continuing service for those subscribers who had changed their address.

The council presumably intended this ban as a bargaining chip to secure from the company a major rate decrease. It followed—and may well have been a response to--the astonishing public statement of an unnamed Chicago Telephone Dompany official (presumably not Fay, since he had already left by this time) that the company had the right to charge whatever rates it pleased, and that if it raised its rates to $500 a year, and decreased its subscriber pool to 1,000, it would still give “absolutely satisfactory service.”[cxlix]

The ban had the effect—which may well have been its intent—of creating an issue around which telephone subscribers could vent their outrage at the company. The following September, 3,000 subscribers--almost half of all the subscribers in the city--signed a petition urging the city council to reduce the company's maximum rate to $75 per year. Rumors swirled about that many of the petition signers had agreed to pay their aldermen as much as $10 apiece should the rate decrease become law—raising the specter that the proposal was corrupt, and that the alderman had been bribed.[cl] (The alderman responded that they used the money to hire to petition-gatherers.)

The following month, Chicago Telephone Company president George Phillips rejected the petitioners' plea, contending that the city council lacked the authority to set rates.[cli]

Undeterred, the city council lobbied the state legislature to grant it such a power, while 400 subscribers who had lost their service when the city council refused the telephone company permission to string additional wires petitioned the city council to force the company to restore their telephone service.[clii]

Few insiders doubted that confiscatory legislation was a real possibility. In St. Louis, the Bell-associated operating company had begun to dismantle its equipment in response to a ruling of the city council that cut telephone rates in half. What was to prevent something similar from taking place in Chicago where, as one editor put it, "no favor has ever been shown to the telephone company"?[cliii] No challenge to the telephone industry in the progressive era-- not even the takeover of the telephone network during the First World War--occurred in a political setting more adversarial, or more fraught with uncertainty, than that which confronted the Chicago Telephone Company in the fall of 1888.

The franchise fight ended with the granting of a new charter for the Chicago Telephone Company in January 1889. Among the concessions the city council wrung out of the company was a clause permitting the installation of public telephones. Telephone subscribers could install a public telephone in any public place provided that they pay the telephone company an extra $25 extra per year. To prevent this privilege from being abused, non-subscribers were supposed to pay the telephone subscriber ten cents every time they made a call.

* * *

The negotiation of right-of-way agreements and the prevention of unfavorable rate legislation were the principal political challenges that the managers of urban operating companies faced in the period between 1879 and 1894. Their greatest organizational challenge

was the design and installation of machinery to rout electrical impulses between different telephone subscribers and the coordination of the operators who tended the machinery.

The most expensive, intricate, and basic of these piece of machinery was the switchboard. In the period between 1879 and 1894, switchboard design advanced rapidly, and in most urban exchanges the switchboard had to be upgraded several times. In Chicago, the main switchboard was rebuilt five times between 1879 and 1888.[cliv] In Buffalo, it was reconfigured three times before April 1881.[clv]

The design of the telephone switchboard for the large urban operating company was largely the work of the ingenious band of self-taught engineers who worked for Western Electric, the Chicago-based electrical manufacturing company that American Bell secured a controlling interest of in 1882. The close physical proximity of Western Electric to the Chicago Telephone Company did much to foster innovation: operating company managers had ample opportunity to suggest improvements, while engineers had little trouble acquiring the hands-on experience that so often has served as a catalyst for change. Key Western Union personnel included Leroy Firman, J. J. O'Connell, and Charles E. Scribner. The machinery they invented was known as a multiple switchboard; when fully refined, it enabled a single operator to connect as many as 10,000 different subscribers.[clvi] (Ten-thousand was the upper limit, owing to the length of the operator's arms.) Its "fundamental idea," as Bell electrician Lockwood explained in 1884, was to enable a single operator to connect subscribers without moving about, and with a minimum of physical exertion. No longer would it be necessary to repeat orders by means of word or mouth or paper slips (known as "tickets").[clvii] Firman designed the first Chicago switchboard, but did not remain in the field for long, leaving Western Electric in 1883.[clviii] O'Connell invented an electric signal that eliminated the need for the subscriber to turn a hand crank to reach the operator—a standard procedure in the early years of the industry.[clix] Scribner devised several

feedback mechanisms—including the ancestor of the modern busy signal--to inform operators when a subscribers sought a connection or a line was in use.

Scribner's inventiveness at Western Electric was by no means confined to telephony.[clx] Only Edison (or so claimed Western Electric partisans) had applied for more patents; and only Edison and Elihu Thompson held more. Edison himself praised Scribner as the most "industrious" inventor he had ever met. Following Scribner's death, AT&T engineer Frank Jewett lauded him as the "acorn" out of which Bell Labs had grown.[clxi] "That the engineering structure which is our glory today exists at the very heart of a great industry," Jewett declared in 1919, "is due to Charles E. Scribner and the men with whom he has surrounded himself." Without Scribner's early leadership, Jewett added, "no such organization as we have today could hope to exist."[clxii]

Like most early telephone inventors, Firman, O'Connell, and Scribner lacked formal engineering training and did not seem to have considered themselves electrical engineers. This may well help explain why they were so soon forgotten. Learning-by-doing was not a method that commended to itself to the next generation of Bell engineers, or to AT&T's first director of research John J. Carty.[clxiii] Like so many twentieth-century industrial scientists, Carty endorsed the now-discredited "linear model" that attributed technical innovations to prior scientific discoveries.[clxiv] Had AT&T retained a research facility in Chicago following Vail's return to the presidency in 1907, Firman, O'Connell, and Scribner might have remained well known--at least within Bell circles. Yet Vail shut down the Chicago research facility soon after he returned; in so doing, he virtually assured that they would be forgotten. Edison may have been the first, but he was by no means the last, inventor-entrepreneur to have his innovations disparaged by his successors as mere "hunt-and-try."[clxv]

Few prototypes for the multiple switchboard existed. Though early designers, such as Firman, did draw on telegraphic precedents, the switchboards used by intra-urban telegraph companies were tiny by comparison. Telephone switchboards were ordinarily designed for networks that consisted of no more than 500 nodes, and were primarily intended to connect subscribers with a central office—a much easier task.[clxvi] Operating company managers, in contrast, needed switchboards that could connect a much larger number of people directly and in a timely fashion. Minimizing the time it took to make a connection was extremely important, since subscribers saw little benefit in a service that was no faster than a messenger boy.

The successful operation of the multiple switchboard depended on the dexterity of the telephone operators who completed the connections necessary to complete a circuit. Automatic switching remained in the future. Every single telephone call routed through operating company switchboards (145,000 a day in Chicago in 1893) required the deliberate intervention of a trained operator, almost all of whom—after the early 1880s--were women. It was an age in which--as one historian has aptly observed--"women were switches."[clxvii] Not until after 1920 would the managers of Bell-associated operating companies begin to supplant the telephone operator with the automatic switching equipment that we take-for-granted today. Theodore Dreiser's fictional heroine, Sister Carrie, may have aspired to a career as an actress, yet for thousands of real-life working women, a position as a telephone operator was one of the very best jobs they could realistically aspire to hold.

For the vast majority of telephone subscribers, on-line delays were an infinitely more pressing concern than the possibility that they might at some point wish to make a long-distance call. Comparatively few subscribers wished to converse with someone thousands of miles of way; all wanted to contact in a timely fashion a business associate, family member, or friend.

Most of the incremental improvements in switchboard design were intended to reduce on-line delays.

Operating company managers constantly strove to reduce the length of the interval between the moment a subscriber contacted an operator and the moment the operator placed the call. Toward this end, they collected elaborate data on average wait times. In 1882, the average wait time for a local connection in Chicago was five minutes; as late as 1887, it remained (for a local connection) 45 seconds.[clxviii] Long wait times helped slow the introduction of automatic switching equipment: one early test revealed that it was actually faster to make a connection through an operator.[clxix] By 1900, operators had reduced the average on-line wait to mere 6.2 seconds--a speed that no automatic could match.[clxx]

The completion of a telephone circuit involved a successful collaboration between at least three different individuals: the operator, the subscriber placing the call, and the subscriber picking up the receiver.

The operators' task was, of course, critically important. Not only did she need to be fast, but she also needed to be accurate. It was, for example, by no means unknown for an operator to connect the wrong parties. One such miscue led a subscriber to try to sue the company for damages. He (or possibly she) was mistakenly connected to the wrong shoe store, and complained to the telephone company when he discovered that he had purchased the wrong pair of shoes. Fay found the grievance ridiculous, and changed the company's contract to absolve it of any liability: if the subscribers were "such fools" as to not know who they were talking to, "it was not our fault, and we would not be responsible."[clxxi]

Subscribers too had to be actively engaged. The "perfect" telephone company, Lockwood observed in 1884, required the active cooperation of the subscriber.[clxxii] In making a connection, one telephone engineer observed, the subscribers did two-thirds of the work.[clxxiii]

The “final completion of a telephone call,” explained Chicago Telephone Company general manager Angus S. Hibbard in 1894, “depends not wholly upon the telephone company or its agent, but very largely, and in many cases almost wholly, upon the intelligent use of the telephone by the subscriber.”[clxxiv] Telephone subscribers, in short, were a necessary part of the machine.

Innovations in switchboard design helped to shield operating companies from competition following the expiration of Bell’s fundamental patents. Henceforth, managers could use their organizational capabilities to prevent competitors from entering the field. The "inner wall" that protected the American Bell Company from competitive assault, telephone engineer Herbert Laws Webb observed in 1892, was its patent portfolio; its "out works" were the strongly entrenched position of the Bell-associated operating companies in the nation’s urban centers.[clxxv]

Patents had been the "nucleus and foundation" around which operating companies had been built, yet they were no longer the "keystone" of the "telephone arch." The expiration of the basic Bell patents, Webb predicted, would thus have "little or no effect" on the telephone operating companies in the large cities. The established companies already "occupied the ground," obliging challengers not only to secure access to cities' streets but also to make a substantial capital investment.[clxxvi]

Operating company managers took it for granted that the equipment they installed would at best remain in service for five years—making the industry a textbook example of the inherent dynamism of capitalism that Austrian economic Joseph Schumpeter would later term “gales” of “creative destruction.” The switchover from grounded to metallic circuits, explained American Bell electrician John J. Carty during a tour of the Metropolitan’s exchange in 1892, had obliged the company to replace in the past half decade every single wire, cable, and switchboard.[clxxvii] "There is no other public service,” Webb concluded, “which is liable to the upheavals that occur

in the telephone business and there are none that is the object of such constant modification and improvement."[clxxviii]

Just as the telephone equipment operating companies relied on had been transformed between 1879 and 1894, so too was their organizational structure. Here, once again, the principal innovator was Hall. Corporations, Hall explained in a paper that he delivered to the NTEA in 1890, had the potential in properly structured to be more efficient than "natural persons."[clxxix] Corporations did not have "souls," yet they need not suffer from "paralysis." To realize their potential, they had to be deliberately designed so that the lines of authority were unambiguous and easily grasped. To make this design explicit, Hall devised an organizational chart.[clxxx] It was, Hibbard reminisced, the "first of its kind I ever saw or heard of."[clxxxi] Organizational charts are sometimes associated with the stifling of innovation. For the managers of late-nineteenth-century telephone operating companies, however, they had the opposite effect. By clarifying lines of authority, they empowered capable managers to coordinate the talents of their subordinates. Or, to put it somewhat more abstractly, they institutionalized entrepreneurship.

The organizational innovations within operating companies that took place between 1879 and 1894 established the foundation for the subsequent melding of the operational companies into a regional—and, eventually, a nationwide and international telephone network. The creation of this network took decades. Yet several of the issues that would long engage network-builders—such as the exclusion of competitors--were discussed early on.

One issue that troubled operating company managers was whether or not telephone companies were (like railroads and express companies) common carriers. The Yale-educated lawyer Morris F. Tyler tackled this issue in the second meeting of the NTEA in 1882. Operating companies, Tyler reasoned, possessed some of the attributes typically associated with common

carriers. For example, they did "enjoy a franchise"; indeed, they could not erect poles and wires without one. Yet they were also distinct from common carriers in various ways. Instead of being open to anyone, their facilities remained restricted to a "well, defined, definite number of people," each one of whom had entered into with the company a "clear and more or less permanent contract."[clxxxii] In this respect, telephone subscribers resembled a "large club"—with the manager of the operating company assuming, like the manager of the club, "some control over its membership."[clxxxiii]

The question of inclusion and exclusion assumed a practical cast when a competitor to Western Union wished to secure from a telephone operating company the same privileges that this company had granted Western Union. Tyler initially did not think that the operating companies could discriminate between two different telegraph companies, but changed his mind after consulting with lawyers at American Bell. Thanks to the Bell patents, the lawyers ruled, the operating companies could refuse to interconnect with whomsoever they pleased.[clxxxiv]

Whether or not American Bell should formalize its relationship with Western Union by purchasing the telegraph giant was a different matter altogether. The purchase of Western Union, American Bell president William H. Forbes predicted in 1888, would in all likelihood prove profitable for both corporations, presumably because it would end competition in the long-distance telegraph market (which American Bell had surreptitiously entered in order to generate revenue for its long-distance lines). Yet Forbes doubted that it would be politically feasible. Congress, the press, and the competitors of Western Union and American Bell (such as, most notably, Postal Telegraph) continued to regard monopoly as pernicious, and such a consolidation might just prompt unfavorable legislation. To be sure, the purchase of Western Union might be "not too unpopular," yet there remained a "very positive danger" that a more formal combination of the two "monopolies"—that is, American Bell and Western Union--would "bring on an

increased uproar and attack" that might result either in the enactment of crippling "rate bills" or even a vote of "acclamation" for "government administration and ownership of the telegraph and telephone."[clxxxv]

That Forbes could consider such a step was a testament to the recent construction by AT&T engineers of its own rudimentary long-distance network. The construction of AT&T's long-distance network was by any measure one of the most remarkable technical achievements in late-nineteenth century electrical engineering. Yet it is important to distinguish between the hyperbolic rhetoric with which its projectors justified its construction, and its practical results.

No one was more sensitive to this distinction between rhetoric and reality than Angus S. Hibbard, a Wisconsin telephone operating company manager who, in 1885, became the first general manager of AT&T. The claims advanced for long distance telephony were so hyperbolic, Hibbard notes sardonically in a report on the subject that he prepared for the September 1885 meeting of the NTEA, that they had "robbed the laborer in this field" of "any laurels he might hope to obtain" by making his accomplishments "appear tame in view of the marvels advertised for his art."[clxxxvi] It had yet to be demonstrated, Hibbard reminded his colleagues, that long-distance service (which were known at the time as "toll lines") could be operated at a profit. This was perhaps not surprising, since the business was so new.[clxxxvii] Not only did major technical obstacles remain to be overcome, but AT&T managers had to devise a way to convince users to take advantage of the new service. Long distance, in short, had yet to be sold. "There has not yet been offered," Hibbard explained in the following year, "what may be called a perfect or popular toll line service, and the possibilities of such a service have not been clearly shown by the present results. When long distance telephony, in a perfected form, is regarded as much of a certainty as railway travel or the United States mail service, it may be assumed that a different class of patronage will be developed." And when it was, this "perfected

service"—free from "distracting annoyances"—would "certainly be regarded as one of the greatest of modern conveniences, and must receive the most extended patronage of a progressive people."[clxxxviii]

Others were more skeptical. Long distance traffic had "always been a source of actual loss to the company," reported Tyler to his stockholders in the annual report of the Southern New England Telephone Company in 1886, even though it had been "fondly regarded" by certain telephone leaders—by whom, Tyler presumably meant Vail--as a source of great profit.[clxxxix] "Stock brokers," observed one commentator in the Electrical Review in 1887, "are not likely to trust in a telephone message" phraseology that might be "indistinct" when they could receive a written message by telegraph.[cxc]

That the spoken word might actually be superior to the written text remained a notion that few contemporaries in the 1880s were willing to entertain. Indeed, it was precisely this limitation of telephony—the fact that it did not leave a recorded message—that prompted Thomas Edison to invent what many regarded as his greatest invention: the phonograph.

Looking back on this period from the vantage point of 1910, the manager of the New York Telephone Company stressed that, for long distance to become accepted, the very "idea" of the telephone business had to be transformed. The "old idea," the manager observed, was that telephone service would be locally based, and that the telephone would replace the district telegraphs that had come into wide use during the 1870s. No one at the time, he reflected, assumed that long-distance would ever become commercially feasible.[cxci]

Hibbard labored mightily to prove the skeptics wrong. Toward this end, in 1889 he devised, in conjunction with John J. Carty and F. P. Pickernel, technical standards for the operating companies that, or so they hoped, might one day make it possible for telephone subscribers to connect to the long distance network from their own telephones. (Long distance

telephony in its early years demanded special equipment that was only available in designated long-distance stations.) In the "new era" that would follow the expiration of the fundamental Bell patents, Hibbard, Carty, and Pickernel declared, Bell-associated companies would dominate their respective localities through a combination of high technical standards—including, in particular, the adoption of the metallic (or two-wire) circuits--and the rigorous training of telephone engineers.[cxcii]

The publication of this report might encourage the presumption that Bell-associated operating companies invested in metallic circuits to facilitate long distance telephone transmission. Yet this was only partly true. Metallic circuits had become necessary by the 1890s also to protect telephone signals from the interference—known as induction—caused by competing electrical utilities—such as streetcar lines and electric power and light grids. Had AT&T never been established, and the “new era” in telephony never been proclaimed, the managers of operating companies in the major commercial centers would still have had to make the conversion from grounded lines to metallic circuits. This was an expensive project that entailed not only the reconstruction of the underground plant but also the rewiring of the switchboard. To the extent that the expansion of telephone service was slowed in the early 1890s, it was primarily for this reason. Once the conversion had been completed, the operating companies were posed for the remarkable burst of expansion that would take place beginning around 1894.

The high technical standards that Hibbard, Carty, and Pickernel proposed in 1889 became, in the period after 1894, a convenient way for Bell licensees to prevent competitors from gaining access to their network. In fact, however, the primary barriers to interconnection were not technical, but strategic. It was “all bosh,” conceded American Bell special agent Frank Colvin in 1900 that Bell telephones would not interconnect with their competitors.[cxciii]

Bell's competitors recognized that interconnection could be a major strategic asset. Following the expiration of the Bell patents in 1894, they lobbied state legislatures to force the Bell licensees and AT&T to interconnect with them, claiming that telephone companies were common carriers.[cxciv] The merits of interconnection struck a particularly chord with the president of the non-Bell Western Telephone Construction Company James Keelyn. Before long, Keelyn predicted in December 1894, state legislators would mandate the "indiscriminate use" of long-distance lines by non-Bell operating companies, while the principal telegraph companies—that is, Western Union and Postal Telegraph—would furnish long-distance facilities in direct competition with AT&T.[cxcv] That neither Western Union nor Postal chose to enter this market—which would continue to be dominated by AT&T--says much about the administrative inertia and technical timidity that had come to characterize the American telegraph industry in the years following its shake-up by Jay Gould.

If the legislatures declined to act, there was always the possibility that the courts might. It would not be long, telephone engineer Kempster Miller declared in 1900, that the courts would decree that telephone companies were common carriers, and demand that Bell licensees interconnect with its competitors.[cxcvi]

In the period after 1900, a number of Bell's competitors—who became known around this time as the "independents"—opposed interconnection on the grounds that it would prevent them from establishing their own long-distance network. Yet this movement lost steam after the leading independent long-distance provider failed in 1908. Congress declared telephone companies common carriers in 1910 and the Justice Department forced AT&T to interconnect with its competitors in 1913.

Not until the establishment of New York-Chicago telephone service in 1892 would it become evident that long-distance telephony had a future. Yet even this triumph did little to

blunt popular hostility toward the industry. Not until after 1900—following the installation of metallic circuits, the switchover to the common battery, and, most important of all, the introduction of measured service—would telephony become genuinely popular in the nation's urban centers. To a considerable degree, the popularization of urban telephony marked the culmination of the long campaign to promote measured service that had been begun in 1881 by Edward J. Hall, Jr. By 1920, the dominant position of the Bell-associated operating companies in the nation's major urban centers had become unproblematic. It had become, as it were, second nature—a taken-for-granted feature of everyday life.

* * *

Few historical accounts of the formative era of the telephone industry accord more than passing mention to the men who ran the operating companies in the period between 1879 and 1894—men such as Edward J. Hall, Jr., Morris F. Tyler, and Charles N. Fay. Yet to a greater extent than the presidents of American Bell—it was they who made the administrative decisions that transformed telephony into a commercially viable (though not yet genuinely popular) enterprise.

The neglect of operating company managers is part of a more general propensity of telephone historians (revisionists as well as triumphalists) to tell the story of telephony in this period from the standpoint of American Bell. Particularly misleading has been the overemphasis on long-distance telephony—which remained until at least 1892 a highly problematic commercial venture that knowledgeable insiders such as Western Union president Norvin Green summarily dismissed as a flop.[cxcvii] Popular hostility toward big city operating companies diminished considerably after 1900 and in the following two decades—a period often

characterized as heyday of the "adversarial relationship" between government and big business in the United States--would only sporadically match the intensity of the telephone subscribers' protests of the 1880s. By rejecting Fay's pessimistic projections with respect to the future potential of the new medium, his successors secured an enormous new cohort of telephone users far less critical of the industry than their predecessors had been. The popularization of urban telephony blunted popular hostility, just as operating company managers had predicted. The waning of popular hostility toward telephone operating companies marked a remarkable shift in an industry that had been routinely reviled in the 1880s as among of the most notorious in the land.

Since the 1790s, social commentators have mythologized innovations in the conveyance of information to highlight the magnitude of the challenge of extending political authority over a geographically extensive domain. From the Pony Express and the Atlantic Cable to the Fast Mail and the establishment of AT&T, they have invested the conquest of space with quasi-millennial important. In so doing, they have unwittingly trivialized other, more seemingly prosaic innovations, such as the commercialization of urban telephony. Generations of historians have unconsciously echoed this spatial bias by characterizing the main trajectory of American economic development in the nineteenth century as extensive.[cxcviii] Far less often, at least in the period prior to advent of the computer, have historians highlighted innovations in the routing of information, such as those that telephone operating managers oversaw in the period between 1879 and 1894.

The commercialization of urban telephony was one such innovation. In a variety of ways, it overturned conventional expectations about the kinds of environments that are conducive to innovation. It owed little to competition, and occurred in--and, indeed, was fostered by--a highly uncertain, maddeningly complex, and often hostile regulatory environment.

In no sense did the Chicago Telephone Company capture the Chicago city council. On numerous occasions in the 1880s, the city council wrested from it valuable concessions; in 1888, it threatened to run it out of town.

The language historians use to characterize the formative era of American telephony compounds the problem. To conflate AT&T or even American Bell with the telephone industry—and to characterize this industry as a "firm" or even a "system"---obscures the contribution of the operating companies to its commercial expansion. More appropriate are relational metaphors such as "association" or "network." Such metaphors highlight the persistence of long-term relationship between organizations that, though linked, retained a distinctive identity.[cxcix]

All the world was not Chicago--or, for that matter, New York. Yet Chicago and New York mattered. In telephony, as in so many other realms, cities were seedbeds of innovation. For it was here that the key innovations in telephone routing—including, above all, the multiple switchboard—were developed and perfected. If America grew up in the country and moved to the city, as one historian once memorably quipped, telephony moved in the opposite direction. Secure in their urban strongholds, the managers of operating companies reached out to the hinterland, and, in so doing, began the momentous transformation of the information infrastructure from a patchwork quilt of largely autonomous systems into the more-or-less seamless web that we have come to take for granted today.

[i] Alan Stone, Wrong Number, The Breakup of AT&T (New York: Basic Books, 1989); Alfred W. Duerig and Constantine Raymond Kraus, The Rape of Ma Bell: The Criminal Wrecking of the Best Telephone System in the World (Secaucus, N. J.: Lyle Stuart, 1988).

[ii] Ithiel de Sola Pool, "Introduction," in The Social Impact of the Telephone, ed. Pool (Cambridge: MIT Press, 1977), p. 8. The "founders," Pool contended—Bell, Hubbard, and Vail—saw the future with "such clarity" because they understood there "may be an inherent determinism" to the "very technology of the telephone" (p. 8). Pool's historical claim echoed—and may well have helped to bolster--the legal defense AT&T lawyers advanced during the 1970s in their ultimately failed attempt to forestall the break-up of the Bell System. Like AT&T's lawyers, Pool traced the origins of the telephone giant to technology and economics rather than politics and culture. Pool's ideas were so closely aligned with those of AT&T's defenders that it should not come as a surprise that the symposia out of which Social Impact emerged had been funded in part by AT&T. Pool dutifully noted AT&T's financial support in his acknowledgements, adding the stock disclaimer that it had come "without strings." There is no reason to doubt that he was being sincere: still, from the standpoint of our post-Bell System age, it is remarkable to reflect on the extent to which such as respected academic as Pool advanced a historical argument that was virtually indistinguishable from a legal brief for AT&T.

Pool was so intrigued by early attempts to forecast how the telephone would come to be used that he published an entire book on the subject. Ithiel De Sola Pool, Forecasting the Telephone: A Retrospective Technology Assessment (Norwood: ABLEX Publishing Corporation, 1983). Having studied 186 forecasts, Pool concluded that Bell and his colleagues conceived of the telephone from the start as a "widely distributed consumer service" (p. 21) that was "always intended" to be universal (p. 6). Both of these conclusions were at variance with the public statements of early Bell-associated operating company managers, such as Charles N. Fay. Like most AT&T triumphalists, Pool did not consult—and does not seem to have been aware of—the published proceedings of the NTEA.

UIC Great Cities Institute

[iii] H. M. Boettinger, The Telephone Book: Bell, Watson, Vail, and American Life, 1876-1976 (Croton-on-Hudson, New York: Riverwood, 1977). Boettinger's inclusion of Watson in his pantheon posed an interpretative challenge that Boettinger seems to have relished. For Watson was not only a spiritualist—a somewhat unsettling predisposition for a telephone engineer—but also an enthusiastic supporter of the late-nineteenth social critic Edward Bellamy, a vigorous champion of the nationalization of public utilities—including the telephone industry. Bellamy dubbed his platform "nationalism"; though he did not consider himself a socialist, it had much in common with the political agenda of the early twentieth century socialist party. Watson, Boettinger concluded, was enough of a pragmatist to recognize that a great deal of "evolution" would have to occur before socialism would become a practicable political program in the United States (p. 120).

[iv] AT&T charter, _____, AT&T Archives, Warren, New Jersey [hereafter AT&T]. These archives have been closed for several years, and, with the recent takeover of AT&T by SBC, are not likely to reopen in their present configuration. All of the AT&T documents that I cite are based on their locations in the AT&T archives in Warren. It is to be hoped that, at some point in the not-too-distant future, this collection might be reassembled in the magnificent archive that SBC has established in San Antonio.

[v] Cited in J. E. Kingsbury, The Telephone and Telephone Exchanges—Their Invention and Development (London: Longmans, Green, & Co., 1915), p. _____. "Such ideas," Bell conceded, "may appear to you Utopian and our of place, for we are met together for the purpose of discussing not the future of the telephone, but its present."

[vi] Arthur W. Page, The Bell Telephone System (New York: Harper & Brothers, 1941), p. _____.

[vii] New York Tribune, 21 December 1884.

[viii] The origins of Forbes's feud with Hubbard may well owe something to Forbes's well-founded suspicion that Hubbard had tried in the late 1870s to sell the Bell patents to Western Union. Henry Lee Higginson to Robert H. Fuller, 23 December 1908, Higginson's private letterbook, XV-2, Higginson Papers, Baker Library, Harvard Business School, Boston, Massachusetts. The late 1870s were a wild ride for telephone investors, and Higginson later recounted that, at some point during the negotiations with Western Union—presumably in 1879—he himself had offered Bell patent's to the notorious financial buccaneer Jay Gould at $1,000 a share. Western Union president

Norvin Green—a "great bully," in Higginson's view—took Higginson's offer seriously and—fearful of a Gould-Bell alliance, swiftly entered into negotiations that led to Western Union's departure from the nascent telephone industry. "Nobody," Higginson added, had at the time "any idea of the value of the Telephone Company" adding that with "courage and ability" it had " gone all out of bounds" and was at present the "best managed large corporation in the world." Higginson to Charles A. Stone, 23 March 1917, Higginson Papers.

[ix] Hubbard to Forbes, 20 January 1884, box 1264, AT&TA.

[x] Hubbard to Forbes, 4 March 1884, box 1264, AT&TA.

[xi] Hubbard to Forbes, 29 October 1885, box 1115, AT&TA.

[xii] Hubbard to Stockton, 21 March 1888, box 1264, AT&TA.

[xiii] Hubbard to Hudson, 23 June 1889, box 1264, AT&TA.

[xiv]Hubbard to Hudson, 20 January 1890, box _____, AT&TA.

[xv] Von Auw, Heritage and Destiny, p. 5.

[xvi] Boettinger, Telephone Book, p. 163, 164. For Boettinger, the key question for telecommunications policymakers was the harnessing of "technical possibilities" to "public desires"—with the "true determinations" of both being the "only safe beacons by which to navigate the course ahead" (p. 186). In many respects, Boettinger's thesis resembled that of the business historian Alfred D. Chandler, Jr., who regarded technology and markets as the principal constraints upon business strategy.

[xvii] Boettinger, Telephone Book, p. 188.

[xviii] Boettinger, Telephone Book, p. 102.

[xix] Edward Mott Wooley, "A $100,000 Imagination," McClure's Magazine, 43 (May 1914): 128-29. Vail remained at Metropolitan, journalist Herbert Casson observed in 1910, until he had completed the construction of an elaborate metallic (that is, two-wire) copper underground system in New York. Herbert Casson, _____.

Trimphalists also downplayed the extent to which Vail's broad conception of the telephone industry had been shaped by his prior experience in the Railway Mail Service (RMS). The influence on AT&T of the insights that Vail had gleaned at RMS was a recurrent theme in magazine profiles of Vail during the 1910s. Vail's early recognition that the telephone had a future, wrote one journalist in Harper's in 1910, could be explained by his

"previous experience" as the head of the Railway Mail Service, which had "lifted him up to a higher point of view." Harper's _____. Similar observations recurred in several of the sketches of Vail published in the first half of the twentieth century by authors closely identified with AT&T. Albert Bigelow Paine, In One Man's Life _____; Arthur W. Pound, The Telephone Idea _____; Page, Bell Telephone System _____.

[xx] Precisely when Vail first conceived of the idea of establishing a nationwide telephone network—as opposed to an archipelago of urban exchanges--is a difficult question. In a 1910 New York state legislative hearing, Vail declared under oath that he could not say for certain when the idea first came to him that he might develop the telephone as a "great big general system." [New York] Senate Report 37, 21 March 1910, p. _____.

[xxi] Milton Mueller, Universal Service; Competition, Interconnection, and Monopoly in the Making of the American Telephone System (Cambridge, Mass.: MIT Press and the American Enterprise Institute Press, 1997); Robert Duncan MacDougall, "The People's Telephone: The Politics of Telephony in the United States and Canada, 1876-1926," Ph. D. diss., Harvard University, 2004.

[xxii] Louis Galambos, "Looking for the Boundaries of Technological Determinism: A Brief History of the U. S. Telephone System," in The Development of Large Technical Systems, ed. Renate Mayntz and Thomas P. Hughes (Boulder, Col.: Westview Press, 1988), pp. 135-53; idem, "Theodore N. Vail and the Role of Innovation in the Modern Bell System," Business History Review 66 (Spring 1992): 95-126; Claude S. Fischer, America Calling: A Social History of the Telephone to 1940 (Berkeley: University of California Press, 1992).

[xxiii] Few histories of the urban telephone exchange in pre-1894 period exist. Nothing at all has been written about Metropolitan--the largest telephone operating company in the world. No Metropolitan records appear to have survived; Verizon (its lineal descendant) does not maintain a corporate archives. The most detailed history of an urban operating company in this period is Ralph L. Mahon's "The Telephone in Chicago: 1877-1940," unpublished manuscript, SBC Archives, San Antonio, Texas [hereafter SBCA]. Mahon prepared his manuscript between 1949 and 1955 under the direction of the interdepartmental history committee at the Illinois Bell Telephone Company. For the New Haven and Hartford exchanges, see J. Leigh Walsh's Connecticut Pioneers in Telephony: The Origin and Growth of the Telephone Industry in Connecticut (New Haven: Telephone Pioneers of America,

1950). On Richmond and Atlanta, see Kenneth Lipartito, The Bell System and Regional Business: The Telephone in the South, 1877-1920 (Baltimore: Johns Hopkins University Press, 1989).

[xxiv] Stephen B. Adams and Orville R. Butler, Manufacturing the Future: A History of Western Electric (Cambridge: Cambridge University Press, 1999), p. _____. According to the Electrical Review, Vail called the meeting because the "boom era" in telephony had ended, and the relations between American Bell and its operating companies were "strained." Electrical Review, _____ (23 May 1885): _____.

[xxv] Electrical Review, _____

[xxvi] National Telephone Exchange Association, Seventh Annual Meeting of the National Telephone Exchange Association… (1885), p. 7. [Hereafter NTEAP]. Time spans refer to the date of the meeting, rather than the publication date of the proceedings.

[xxvii] _____ [NTEA founded due resentments of American Bell by operating company managers]

[xxviii] James Drummond Ellsworth, "The Twisting Trail," p. 57, box 1066, AT&TA.

[xxix] Vail to American Bell executive committee, _____, SBCA.

[xxx] Bradley to Hubbard, 8 October 1878, _____, SBCA.

[xxxi] Hjortsburg to Hubbard, 8 October 1878, _____, SBCA.

[xxxii] Hubbard to Vail, 9 October 1878,_____, SBCA.

[xxxiii] Charles N. Fay has left little impression on history. He is probably best remembered as a founder of the Chicago Symphony Orchestra. Fay secured his position at Chicago Telephone through the influence of his cousin, Richard S. Fay, a business associate of Forbes. William O. Kurtz, "The Telephone in Chicago" [1944], _____, SBCA. Fay left Chicago Telephone in 1887 to became president of the Chicago "Gas Trust." Among his principal qualifications for this position—which earned him the princely salary of $20,000—was his proven track record as a political gamesman. Just as Fay had "skillfully squeezed the public for one corporation"—or so observed a journalist in the trade press—"he was likely to prove an expert in squeezing it for another." Electrical Review, _____ (21 January 1888): _____. Fay's sudden departure from Chicago Telephone on the eve of the debate over the re-chartering of its franchise may help to explain why this contest proved so acrimonious.

[xxxiv] NTEAP (1886), p. 7.

[xxxv] Hudson to _____, 29 October 1887, _____, AT&TA.

[xxxvi] NTEAP (1882), p. 11.

[xxxvii] NTEAP (1882), p. 11.

[xxxviii] [1881 American Bell Annual Report]

[xxxix] Electric Age, _____ (_____1899): _____.

[xl] Electrical Review, _____ (7 October 1893): _____. Chicagoans made more telephone calls than New Yorkers, even though New York had more telephones, because they made more telephone calls in the afternoon. Electrical Engineering, _____ (December 1894): _____. See also Western Electrician, _____ (7 January 1899): _____.

[xli] T. Commerford Martin, _____, North American Review, _____ (_____1888): _____.

[xlii] Charles Barnard, "The Telegraph of To-Day," Harper's _____ (October 1881): _____.

[xliii] Nathaniel Hill, _____. [speech on facsimile]

[xliv] Elisha Gray, "A Revolution in the Means of Communication," Cosmopolitan _____ (May 1893): _____.

[xlv] Commercial and Financial Chronicle, _____ (27 June 1885): _____. See also Electrical Review, _____ (23 October 1883): _____.

[xlvi] Electric Age, _____ (13 September 1890): _____. The editorialist added that the telephone had a great future and that it was in good and intelligent hands.

[xlvii] Electrical Review, _____ [supremest invention]

[xlviii] Edward W. Bemis, Report on the Investigation of the Chicago Telephone Company (Chicago: n. p., 1912), p. 8. "The AT&T," Bemis observed, was the "usual abbreviation" of American Telephone & Telegraph. See also the testimony of Vail, [New York] Senate Report 37, p. 397.

[xlix] The recent ascendancy of the former Bell operating companies Verizon and SBC will inevitably encourage a rethinking of telephone history that will emphasize those features of the Bell System--such as the urban

telephone exchange--that recent historical accounts underplays. It is, in short, an opportune time to deconstruct the Bell System.

[l] See, for example, William D. Caughlin, Brian F. Coffey, and Ilana N. Pergam, Snapshots in Time: A Photographic History of Ameritech (Chicago: Ameritech, 1999), and Herbert J. Hackenburg, Muttering Machines to Laser Beams: A History of Mountain Bell (Denver: Mountain Bell, 1986).

[li] Thomas P. Hughes, American Genesis: A History of the American Genius for Invention (New York: Penguin Books, 1990), p. 2.

[lii] George L. Priest, "The Origins of Utility Regulation and the 'Theories of Regulation' Debate," Journal of Law and Economics, 36 (April 1993): 289-329. See also Werner Troesken, Why Regulate Utilities? The New Institutional Economics and the Chicago Gas Industry, 1849-1924 (Ann Arbor: University of Michigan Press, 1996); Harold L. Platt, The Electric City: Energy and the Growth of the Chicago Area, 1880-1930 (Chicago: University of Chicago Press, 1991); and Christopher Armstrong and V. H. Nelles, Monopoly's Moment: The Organization and Regulation of Canadian Utilities, 1830-1930 (Philadelphia: Temple University Press, 1986; paperback: Toronto: University of Toronto Press, 1988).

[liii] Orton to James Merrihew, 8 June 1876, president's letterbooks, Western Union Collection, Smithsonian Institution, Washington, D. C. [hereafter WUC-SI]. The "great public"—opined an editorialist in the Electrical Review as late as 1885--had never objected to overhead wires; the issue appealed primarily to the wealthy, who resented the presence of overhead wires in the vicinity of their personal residences. Should these individuals wish to install underground conduits, they had abundant resources to foot the bill. Electrical Review, _____ (23 May 1885): _____.

[liv] Chicago City Council, Proceedings, 27 December 1875, p. _____.

[lv] Chicago Tribune, 1 August 1880.

[lvi] Chicago City Council, Proceedings, 21 February 1877, p. _____.

[lvii] NTEAP (September 1881), p. 18.

[lviii] NTEAP (1883), p. 31.

[lix] NTEAP (1882), p. 22.

[lx] NTEAP (1882), p. 22.

[lxi] Electrical Review, _____ (27 December 1883): _____.

[lxii] Electrical Review, _____ (6 March 1884): _____.

[lxiii] Williams to Vail, 6 March 1883, _____, SBCA. At the time, Vail was the largest stockholder in the Chicago Telephone Company.

[lxiv] [annual report of New England Telephone Company for 1884 and 1885]. Supporters of underground wire legislation, Vail warned, were often self-interested inventors with patents to sell. Vail was equally skeptical about the legislative regulation of telephone rates. Even the "best" telephone operating company managers, he observed, did not know how set rates. How, then, could state legislatures? Vail looked, instead, to the "self-interest" of the individual operating companies as well as to the workings of supply and demand. _____, p. _____.

[lxv] NTEAP (1884), p. 43.

[lxvi] W. Bernard Carlson, "Entrepreneurship in the Early Development of the Telephone: How Did William Orton and Gardiner Hubbard Conceptualize the New Technology?" Business and Economic History, 23 (Winter 1994): 161-192.

[lxvii] Mabel Bell to _____, _____, Bell Papers, Library of Congress [henceforth BP-LOC]. Mabel Bell opposed a sale of Bell's patents to Western Union, as did (she reported) her husband the inventor; yet she feared that such a buy out might well occur.

[lxviii] Forbes to Storrow, January 1880, in Pier, Forbes, p. _____.

[lxix] Bell to _____, 27 June 1876, _____, BP-LOC.

[lxx] Orton to Samuel S. White, 1 March 1878, president's letterbooks, WUC-SI. That Orton recognized the value of the telephone is indisputable. Western Union had entered into negotiations with Bell, Orton wrote a colleague in 1878, to establish a single telephone combine linked with Western Union subsidiary Gold and Stock: "Whenever this is done, the company controlling the whole will have one of the most valuable rights in the United States." Orton to Gamble, 23 February 1878, president's letterbooks, WUC-SI.

[lxxi] John Murray Forbes to _____.

[lxxii] NTEAP (1887), p. 66.

[lxxiii] NTEAP (April 1881), p. 119.

[lxxiv] NTEAP (April 1881), p. 118.

[lxxv] New York Times, 29 August 1901. Five year later, the Times conceded that it might have been mistaken. New York Times, 22 January 1906. The notion that the average cost of running a telephone exchange increased as its size increased was accepted by legislators relatively quickly. It was a "universally accepted theory," declared New York state legislator Danforth E. Ainsworth in 1888--in a report on the state of the telephone industry in the United States--that the cost per capita of operating a telephone exchange increased in a nearly geometric ratio to the number of subscribers. [1888 NY investigation].

[lxxvi] Simon Sterne, _____ [1889].

[lxxvii] _____, SBCS. [subscription's card].

[lxxviii] Western Electrician, 14 (10 February 1894): 67.

[lxxix] Electrical World, 40 (8 November 1902): 752. This article ridiculed the presumption that non-subscribers should be permitted access to free telephone service at drug stores and other public places. Significantly, the author nowhere challenged the right of subscribers to enjoy this privilege. In Milwaukee, retail druggists fought the attempt by operating company managers to require public telephone users to pay a ten-cent fee. Telephone subscribers, they contended, should be able to use whatever telephones they chose free of charge—including public telephones installed in stores. Western Electrician, 14 (10 February 1894): 67.

[lxxx] Metropolitan Telephone Company subscriber's list, 1884, Warshaw Collection, Archives Center, Smithsonian Institution. The president of Metropolitan was Vail.

[lxxxi] Electrical Review, _____ (19 July 1884): _____. The principles of telephone rate setting had yet to be carefully studied, Vail informed Chicago Telephone Company president Norman Williams in 1885. Vail doubted that a single set of principles could be devised, since the cos of telephone service was dependent on factors that differed from company to company. Vail to Williams, 16 May 1885, _____, SBCA.

[lxxxii] NTEAP (1880), p. 183.

[lxxxiii] Electrical Review, _____ (18 October 1884): _____.

[lxxxiv] Telephone users in Chicago resisted measured service, one editorialist opined, in the expectation that flat rates would popularize the new medium, just as flat rates had popularized the speaking tube. Electrical Review, _____ (22 November 1884): _____. Flat rates may well have popularized telephone service among subscribers, yet it did little to popularize it among non-users—which was, as the time, the vast majority.

[lxxxv] NTEAP (1880), p. 175.

[lxxxvi] NTEAP (1880), p. 179.

[lxxxvii] NTEAP (1880), p. 180.

[lxxxviii] NTEAP (1880), p. 175.

[lxxxix] NTEAP (April 1881), p. 121. One or two companies, Hall added, had dropped the fixed rental altogether and "established rates solely on message service." He was referring, presumably, to the Bell associated operating companies in Buffalo and San Francisco. No other urban exchange is known to have adopted measured service on a large scale prior to 1894, when it was introduced in New York. The advent of measured service in New York was, in many respects, a more important milestone than the expiration of the second of Bell's fundamental telephone patents. More than any other single factor, it laid the groundwork for the remarkable upward spike in the installation of telephones in the major urban exchanges in the two decades after 1894.

[xc] NTEAP (1880), p. 176.

[xci] Hall to William M. Mallett, 10 October 1886, in Rochester Union and Advertiser, 22 October 1886.

[xcii] "The Telephone Dead Head Evil," Electrical Review, 5 (28 February 1885): 5.

[xciii] NTEAP (1880), p. 177.

[xciv] NTEAP (1880), p. 182.

[xcv] NTEAP (1880), p. 183.

[xcvi] NTEAP (April 1881), p. 128. Only one protest, Hall reported, followed the introduction of measured service in Buffalo: in a fit of pique, twenty lumberman banded together and ordered their telephones removed.

[xcvii] It would be easy to sympathize with the telephone subscribers: everyone, after all, wants lower utility rates. Yet it is at least worth considering whether the operating company managers might have had a point. The enactment of maximum rate laws might well have slowed the introduction of new devices and techniques and stifled

the expansion of telephone service. Without a doubt, this was its effect in Indiana—the only state to enact such a law. In addition, such legislation would have made it harder for the managers of the large urban telephone operating companies to experiment with measured service—and, thus, might well have slowed the expansion of telephone service in the nation's major urban centers. Had state governments regulated telephone rates through statutory enactment, it would have been more difficult—and conceivably even impossible--for telephone managers to institute the elaborate rate schedules that became such a ubiquitous feature of telephone practice in the decades after 1894.

[xcviii] NTEAP (1886), p. 85. Forbes reached a similar conclusion. The value of American Bell "wholly depends" on the patents it held—and no state government should be permitted to destroy property that the patent system had created. Forbes to _____, Pier, Forbes, _____,

[xcix] NTEAP (1885), p. 95.

[c] Executive committee minutes, Central Union Telephone Company, _____, SBCA.

[ci] Electrical Review, 9 (5 February 1887): 4.

[cii] Electrical Review, _____ (9 March 1889): _____. Following the repeal of the law, the management of Central Union vowed to reorganize its exchanges and "do away with the obnoxious toll system." The repeal of the rate law, one editorialist opined, should destroy the popular movement to enact "injudicious and often malicious, rate legislation" that was currently pending in many many state legislatures

[ciii] NTEAP (1885), p. 95.

[civ] The elision of the distinction between different kinds of strikes troubled one laborer, who complained that, had telephone company employees struck (instead of telephone subscribers) the operating company managers would have called out the militia. Rochester Post-Express, 2 December 1885.

[cv] NTEAP (1885), p. 95.

[cvi] NTEAP (1886), p. 77.

[cvii] Electrical Review _____ (26 December 1894): _____.

[cviii] NTEAP (1885), p. 102.

[cix] NTEAP (1885), p. 103. The previous year, Fay observed, a trio of "enterprising gentlemen" had introduced an identical telephone rate bill in Illinois, Ohio, and Indiana. That the Illinois legislature might enact

such as law was an abiding concern. The Illinois Senate, Fay warned Vail in June 1885, had recently endorsed a telephone bill that might prove to be "dangerous"; some "granger members" might get it through the lower chamber, by taking advantage of "the sheer popularity of the attack on the telephone company." Fay to Vail, 5 June 1885, _____ SBCS.

[cx] Western Electrician, 16 (16 March 1895): 134.

[cxi] Chicago City Council Proceedings, _____ [refusing permits for Chicago Telephone]

[cxii] Simon Sterne, _____ [Board of Trade and Transportation pamphlet].

[cxiii] NTEAP (1887), p. 29.

[cxiv] ["telephone war"]

[cxv] Rochester Post-Express, 20 November 1886; Rochester Union and Advertiser, 20 November 1886.

[cxvi] Rochester Democrat and Chronicle, 15 May 1888. To test the resolve of the boycotters, one editor made an experimental telephone call shortly after the telephone strike had begun. When the strikers learned of his experiment, they warned the editor that, should he persist, local merchants would stop advertising in his newspaper._____ Boyd to American Bell, _____. AT&TA.

[cxvii] F.J. Amsden to William M. Mallett, 22 December 1886, _____, AT&TA.

[cxviii] Rochester Democrat and Chronicle, 16 February 1888, 20 March 1888.

[cxix] Rochester Democrat and Chronicle, 25 November 1886.

[cxx] Hall to Hudson, 15 December 1886, _____ AT&TA.

[cxxi] Rochester Democrat and Chronicle, 2 November 1886.

[cxxii] Rochester Union and Advertiser, 2 November 1886.

[cxxiii] Rochester Democrat and Chronicle, 2 December 1886.

[cxxiv] Frederick Leland Rhodes, Beginnings of Telephony (New York: Harper & Brothers, 1929), pp. 220-23.

[cxxv] Parker had come to American Bell on the recommendation of Vail. Forbes had sought in 1883 to recruit someone with "executive experience"—and Parker, a twenty-year veteran of the Post Office Department—was an obvious choice. David Bigelow Parker, A Chatauqua Boy _____.

[cxxvi] Rochester Democrat and Chronicle, 15 November 1887, 25 February 1888. According to the Democrat, Parker was the "shrewdest and sharpest man in the telephone company."

[cxxvii] Vail to _____, AT&TT.

[cxxviii] "Report of the Committee to Investigate Telephone Charges," 7 March 1888, New York State, Report 60. "We are of the opinion," the report concluded, "that the toll system [that is, measured service] is decidedly the most equitable, when based upon a fair and reasonable schedule of prices, but its adoption does not seem to meet with favor by the people of the State" (p. 12).

[cxxix] Rochester Union and Advertiser, 15 March 1888.

[cxxx] Electrical Review, 7 March 1885.

[cxxxi] Forbes to Higginson, 18 March 1886, in Pier, Forbes, _____.

[cxxxii] [ownership of American Bell stock]

[cxxxiii] Forbes to Higginson, 18 March 1886, in Pier, Forbes, _____.

[cxxxiv] NTEAP (1886), p. 6.

[cxxxv] NTEAP (_____), p. _____

[cxxxvi] NTEAP (1886), p. 7.

[cxxxvii] NTEAP (1886), p. 7.

[cxxxviii] NTEAP (1886), p. 7.

[cxxxix] NTEAP (1886), p. 7.

[cxl] NTEAP (1886), pp. 7-8.

[cxli] NTEAP (1886), p. 8.

[cxlii] NTEAP (1887), p. 22-23.

[cxliii] NTEAP (1887), p. 24.

[cxliv] NTEAP (1887), p. 34.

[cxlv] NTEAP (1887), p. 34.

[cxlvi] NTEAP (1887), p. 34.

[cxlvii] NTEAP (1887), p. 34.

[cxlviii] Western Electrician, 2 (25 February 1888): 16; Western Electrician, 3 (25 August 1888): 97. The assault of the Chicago City Council on the Chicago Telephone Company began in the weeks immediately preceding the long-anticipated ruling of Supreme Court Chief Justice Morrison Waite in the Drawbaugh patent infringement case. Less than two weeks after Waite's decision became public, the council granted a franchise to the Cushman Telephone Company—a rival of the Chicago Telephone Company. In so doing, it tried to nullify what many regarded as an outrageous Supreme Court decision.

[cxlix] Electrical Review, 21 January 1888. Newspaper editors, the journalist declared, were using the "muck-rake" to attack the telephone company.

[cl] Western Electrician, 3 (29 September 1888): 174. One alderman felt it necessary to deny that these payments were contributions to a "corruption" fund. In fact, he contended, the payments were necessary to remunerate the twelve men the aldermen had hired to circulate the petition. The principal "agitators," reported Western Electrician, were the leaders of the Chicago Druggists Association. Western Electrician, 4 (5 January 1889): 6.

[cli] Western Electrician, 3 (17 November 1888): 258; Western Electrician, 3 (24 November 1888): 270.

[clii] Western Electrician, 3 (22 December 1888): 313.

[cliii] Western Electrician, 2 (23 June 1888): 310. Officials of the Bell-licensee in St. Louis threatened to leave Missouri if the St. Louis city council passed a maximum rate law. Shortly thereafter, a Missouri judge ruled that the St. Louis city council lacked the authority to set telephone rates. Western Electrician, 3 (29 December 1888): 330.

[cliv] Kurtz, "Telephone in Chicago," p. _____.

[clv] NTEAP (April 1881), p. 123.

[clvi] Enos Barton later reminisced that the multiple switchboard patents held by Western Electric were the single most important reason for the company's success. Enos Barton, _____, SBCA archives.

[clvii] Electrical Review, 7 February 1884.

[clviii] Walsh, Connecticut Pioneers, p. _____

[clix] _____ Borden, _____, SBCA.

[clx] Scribner has been largely ignored by historians not directly connected with Western Electric; he does not, for example, even appear in the index of Hughes's American Genesis.

[clxi] Hibbard, Hello, Goodbye, p. 150.

[clxii] Frank Jewett, Western Electric News, _____ (_____1919): _____.

[clxiii] Lilian Hoddeson, "The Emergence of Basic Research in the Bell Telephone System, 1875-1915," Technology and Culture, 22 (July 1981): 512-44. Hoddeson challenged the many historians who, following Carty, treated Vail's consolidation of the research activities after 1907 as a fundamental break with the past. Bell engineers, Hoddeson demonstrated, had always been shaped by a determination to solve particular problems. In this respect, nothing changed in 1907.

[clxiv] David A. Hounshell, "Industrial Research and Manufacturing Technology," in Encyclopedia of the United States in the Twentieth Century, ed. Stanley I. Kutler (New York: Charles Scribner's Sons, 1996), 2: 831-57. In this essay, Hounshell challenged the longstanding presumption of industrial researchers (which he termed the "linear model") that scientific breakthroughs inevitably spawned innovations with major commercial applications.

[clxv] Hughes, American Genesis, p. 181. Spokesmen for the nation's first industrial research laboratories, Hughes observed--including John J. Carty—had the unfortunate propensity to trivialize the prior contributions of inventors such as Edison (or, he might have added, Scribner). They did so, in large part, to amplify their own contributions to industrial research.

[clxvi] The district telegraph established in New York in the 1870s to facilitate communication between law offices connected a mere 70 offices. Albany Law Review, _____ (July 1875): _____. For a related discussion, see J. E. Kingsbury, The Telephone and Telegraph Exchanges: Their Invention and Development (London: Longmans, Green & Co., 1915), chap, 14.

[clxvii] Kenneth Lipartito, "When Women Were Switches: Technology, Work, and Gender in the Telephone Industry, 1890-1920," American Historical Review, 99 (October 1994): 1075-1111.

[clxviii] Mahon, "Telephone in Chicago," p. 7. In 1882 it took five operators (young boys) to complete a local call.

[clxix] Electrical World, 35 (10 March 1900), p. 366. According to Bell expert I. H. Farnham, it took telephone users 11 seconds to make a connection if they relied on automatic equipment--but only 4 seconds if they relied on an operator. Automatic equipment was hard to use in the dark and increased the possibility that subscribers might dial and wrong number. By 1914, the Chicago Telephone Company's operators were reputed to answer 96 percent of all calls in 10 seconds or less, with an average of 4 seconds. Public Service, 16 (March 1914): 81.

[clxx] Western Electrician, 28 (23 March 1901): 198.

[clxxi] NTEAP (_____), p. _____

[clxxii] Electrical Review, _____ (24 May 1884): _____.

[clxxiii] Webb, "The Telephone of To-Day," New England Magazine _____ (June 1894): _____.

[clxxiv] Electrical Engineering, _____ (December 1894): _____.

[clxxv] Western Electrician, 9 (25 July 1891): 44. The "main strength" of American Bell, the Electrical Review declared three years later, was, it has "always believed," not its patents, but its "magnificent system of exchanges, a chain of companies bound together by the long distance system." Electrical Review, 25 (26 December 1894): 1. The editor went on to speculate that American Bell might actually have lost money on its patent litigation.

[clxxvi] Engineering Magazine, 2 (March 1892): 754, 755.

[clxxvii] Western Electrician, _____ (30 April 1892): _____.

[clxxviii] Engineering Magazine, 2 (March 1892): 755.

[clxxix] NTEAP (1890), p. _____

[clxxx] Hall's chart was reproduced in the 13 September 1899 issue of Electric Age.

[clxxxi] Hibbard, Hello Goodbye, p. _____. There existed no "diagram of organization" for the Chicago Telephone Company as late as 1893—reported Angus Hibbard in his memoir. The absence of an organizational chart slowed Hibbard's attempt to integrate the operating company into the long-distance network.

[clxxxii] NTEAP (1882), p. 29.

[clxxxiii] NTEAP (1882), p. 29. The presumption that telephone companies were not common carriers continued to be voiced by industry insiders as late as 1900. Engineering Magazine _____ [1900]. The issue would not be settled—and then only for interstate telephone service—until the Mann-Elkins Act in 1910.

[clxxxiv] NTEAP (Sept. 1881), pp. 14-15. See also Electrical Review, _____ (14 March 1885): _____.

[clxxxv] Forbes to _____, 5 April 1888, _____, AT&TA.

[clxxxvi] NTEAP (1885), p. 61.

[clxxxvii] NTEAP (1885), p. 66.

[clxxxviii] NTEAP (1886), p. 120.

[clxxxix] [SNET annual report, 1886].

[cxc] Electrical Review, _____ (6 April 1887): _____.

[cxci] [New York] Senate Report 37, p. _____ [long distance not feasible]

[cxcii] NTEAP, _____. ["new era"]

[cxciii] Frank Colvin to _____, Colvin letterbooks, _____AT&TA.

[cxciv] Electrical Review, _____ (21 March 1894), p. _____.

[cxcv] Electrical Review, _____ (26 December 1894): _____.

[cxcvi] Engineering Magazine _____ [1900]. It is worth underscoring that that, as late as 1900, it had yet to be assumed that telephone operating companies were common carriers.

[cxcvii] Norvin Green to _____, president's letterbooks, WUC-SI [on the failure of long distance]

[cxcviii] Louis Galambos, America at Middle Age: A New History of the United States in the Twentieth Century (New York: McGraw-Hill, 1983), p. 16.

[cxcix] For a related discussion, see Naomi R. Lamoreaux, Daniel M. G. Raff, and Peter Temin, "Beyond Markets and Hierarchies: Toward a New Synthesis of American Business History," American Historical Review, 108 (April 2003): 404-33.