

## British Business and the Telephone, 1878-1911.

Graeme J. Milne

### Abstract

Most research into the early telephone system has focused on telephone providers rather than users, and this article begins to address that imbalance. The telephone was initially used to improve internal communications within firms, by connecting offices with warehouses, or by enabling staff working away from the office to report back. With the expansion of exchange networks, the commercial, intermediary and brokering sectors became heavy users of the technology for routine information transfer within business districts. Business elites continued to favour face-to-face contact for strategic business negotiations, however, and delegated telephone use to their employees.

### Keywords

Telephones; office practice; business communications; white collar workers; urban infrastructure

The volume of research into the early telephone is now considerable, but it remains geographically and thematically limited. Most of the literature relates to the United States or Canada, and most focuses on the producer side of the industry, with the telephone companies being investigated as providers of systems and networks, and as early adopters of large-scale corporate managerial structures. Few historians have written, even in part, on demand and use aspects of the telephone in the nineteenth century.

This article begins to address these gaps by assessing business use of the telephone in Britain during the three decades between the introduction of the technology in the late 1870s and nationalisation of the network in 1911. The first section has a brief survey of the existing literature and an overview of the development of the early British telephone system. It also considers the fundamental question of rates and charging structures, which had far-reaching implications both for the growth of the network and for the adoption and use of the telephone by firms. The remaining sections consider the use of the telephone by business, paying particular attention to the related questions of where telephonic communication stood in relation to the boundaries of the firm, and what effect the technology had on the roles of owners, managers and employees in business offices.

## I

The business history of the early telephone is dominated by the telephone companies themselves. Much of the literature consists of institutional, strategic and managerial histories, many drawing on the formidable archives of the American Telephone & Telegraph Co. (AT&T); these resources have inspired several volumes of work on the constituents of the Bell system and its role in the development of the industry in North America.<sup>1</sup> Even when not focusing directly on the telephone companies, however, historians in a variety of fields have still concentrated on the producer/provider side of the industry. Historians of technology have written about instruments, wires and switchboards, all of which posed scientific and technical challenges, as well as political and administrative problems when attempting to integrate wires with existing urban infrastructure.<sup>2</sup> Students of labour, ethnicity and gender have focused on the new occupations that emerged from the early telephone system, especially the telephonist.<sup>3</sup> Historical geographers and economic historians have made innovative use of expanding telephone networks to assess information flows, urbanisation patterns, competition and regulation.<sup>4</sup> Work on the early British telephone network has followed the lead of most contemporary commentators, with much emphasis on institutional rigidities and the planning blight caused by extended debates over nationalisation and licensing in the 1880s and 1890s; inevitably, this too tends to focus on provider rather than user perspectives.<sup>5</sup>

The volume of work published on the user side of the industry is much smaller, and again, North American material dominates. The once-widespread farm networks in the United States have been described as ‘a consumer-driven diffusion, perhaps even a social movement’, in a rare study that makes some attempt to balance evidence from users and providers alike.<sup>6</sup> In addition, the social uses of the telephone, initially discounted by the telephone companies, became an important element in expansion of the system the 1920s, after early decades of largely business use.<sup>7</sup> Three studies (two North American, one British) have assessed adoption patterns in urban areas, demonstrating in valuable detail the competing dynamics that drove business and social diffusion of the technology in the early years.<sup>8</sup> Overall, though, there is a dearth of published research into the adoption of telephones by business, and the incorporation of the technology into business practice and office management: this, despite the growing awareness that the late nineteenth century office was the scene of considerable innovation in filing, copying and other

information-handling processes.<sup>9</sup> Little work has been done on the implications of the telephone for the internal organisation of the firm, or the communications patterns of firms, networks and business districts. We know least of all about actual telephone use, as opposed to telephone adoption—as will be seen, the day-to-day use of the technology in offices varied widely from firm to firm, even within the same sector.

Before considering business use of the telephone, a brief survey of the system's early development will be useful. Telephones competed with a number of entrenched communications systems—the mail, the telegraph, and urban messenger services—and for technical and revenue reasons required locational critical mass to justify investment in wiring, poles and exchange buildings. The technological feasibility of services beyond a short distance was initially uncertain, and the first systems were installed in Britain by private telephone companies at their own risk, rather than being coordinated and subsidised by the Post Office. Business and professional use in compact urban districts offered the best hope of a concentrated user population willing to pay relatively high charges for the new technology. In Glasgow, for example, the first exchange was aimed at connecting physicians, pharmacists and hospitals; this was followed quickly by exchanges for stockbrokers, lawyers, and business in general, before the entire system was interconnected into one network.<sup>10</sup> There were of course many more businesses than doctors and lawyers in British cities, so business rapidly overtook professional use, but the early recruitment of professionals was considered 'a first class piece of salesmanship'.<sup>11</sup>

By the late 1890s, critics argued that this local, uncoordinated strategy, while successful in building a system without public subsidy, had held back British telephone adoption in relation to that of competitor nations. In the words of the 1898 Parliamentary Committee set up to investigate the system, the service remained limited

in the United Kingdom chiefly to England, in England to urban districts, in urban districts to the commercial classes, among the commercial classes mainly to merchants and large tradesmen, and among them to those only who find it advantageous to become subscribers.<sup>12</sup>

Telephone companies initially targeted business districts in London and in the commercial and industrial centres of the north of England and the central belt of Scotland, and then exploited rapidly-improving technology to make these cities regional exchanges for compact networks of local and trunk lines within about a thirty-mile range. Thus the Northern District Telephone Co. connected the shipping, coal and steel complex of the North East coast between Newcastle and Middlesbrough; the National Telephone Co. built a line from Glasgow to Edinburgh, and expanded outward into the Forth and Clyde industrial belt; and the Lancashire & Cheshire Telephonic Co.'s zone around Liverpool was connected with other clusters through Manchester to Leeds and Sheffield, building a network that was appreciably more dense than those in other parts of the country. In 1889, the Lancashire & Cheshire and the National joined with London's United Telephone Co. to form a reconstituted National Telephone Co., and the NTC became Britain's dominant telephone provider until the network was transferred to the Post Office in 1911.<sup>13</sup>

The broad industrial zone of the north of England was the most densely developed part of the NTC network, with higher rates of calls per line than in London (table 1). The trans-Pennine corridor is prominent in the table, as is lowland Scotland, the Potteries (Hanley) and the North East. It is possible that London firms were earlier adopters of multiple lines, which would have served to lower the average overall, but anecdotal evidence suggests that there was a real difference in usage: in 1895, the NTC President testified that the 'telephone in London has not become so essential a part of the commercial machinery as in Liverpool, or Manchester, or Leeds'.<sup>14</sup> Most likely, the

London figures are affected by the sheer variety of businesses working in the capital, and by a disproportionate number of less-used telephones in private houses and government offices.

International comparisons suggest that Britain was appreciably slower to adopt the telephone than the United States and some European countries, most notably Sweden, and critics blamed existing competitor technologies, institutional rigidities and high charges for this relative backwardness.<sup>15</sup> The telegraph system, a Post Office monopoly run with a heavy public subsidy, was a formidable competitor over long distances, and reductions in telegraph rates—including one in 1883 just as the telephone network was beginning to expand—enabled the Post Office to maintain its hold on longer-distance messaging.<sup>16</sup> Short-distance telegraphy, however, was badly hit by the telephone, contributing further to the already poor financial performance of the telegraph.<sup>17</sup> The Post Office therefore used its powers to limit the telephone companies' operating licences, and took over the long-distance lines in the 1890s, denying the NTC the opportunity to build a truly integrated national network. It also targeted particular elements of the system that seemed to threaten the telegraph, for example in restricting the installation of 'call offices' in public places for the use of non-subscribers; these therefore developed much more slowly than in other countries, most notably in the United States, where the drugstore telephone became ubiquitous.<sup>18</sup> At local level, some municipalities refused to allow telephone companies to lay underground cables, resulting in unreliable services: Glasgow was the most extreme case.<sup>19</sup>

Telephone charges had important consequences for the development of the network, and for the differential adoption rates evident between various categories of user. High up-front subscription models excluded most of the population from having a domestic telephone in many countries, and the Canadian record on this point has been interpreted as an ideological opposition by capital to the diffusion of telecommunications among the working classes.<sup>20</sup> In Britain, too, the NTC President claimed in 1895 that he did 'not think any working man, not one in a hundred thousand, would ever use the telephone', and rejected the suggestion that this was due to its cost; he argued that small tradesmen and shopkeepers were a possible market, however, and would be the subject of a concerted campaign to persuade them of the system's benefits.<sup>21</sup>

The charging regime continued to be problematic. Until 1907, British telephone providers operated a flat-rate subscription model, with no additional call charges for local calls, although long-distance calls carried a separate charge for each three-minute call. The subscription varied from company to company and over time; £20 was a common annual figure in the early 1880s, with a complicated tariff for extra lines and instruments, but subscriptions had fallen to £10-15 by the 1890s. From 1907, new subscribers were given a 'measured' rate, which consisted of a lower subscription (£5-6), an allowance of between 360 and 500 calls, and a call rate for any additional calls (again, there were local variations). Many existing subscribers were allowed to retain the legacy flat rate, however, and the pricing regime remained confused and regressive. The charging regime was not reformed again until the 1920s, when a Parliamentary committee recommended a 'message' rate, based on a charge for each call as 'the only strictly equitable basis of charging for telephone service'.<sup>22</sup>

In its first generation, therefore, adoption and use of the telephone in Britain has to be assessed within the flat rate environment, which set a relatively high entry-threshold and favoured large users of the telephone. Critics argued that a 'wealthy minority' had paid 'a subscription in many cases disproportionate to the assistance the telephone exchange system has been to their business', and was denying access to the system not just to a broader public, but to large sections of business and industry below the elite.<sup>23</sup> Subscriptions also had to be paid annually in advance, which was believed to be a considerable deterrent to smaller users.<sup>24</sup> Large firms, such critics argued, were restricting their own businesses in the longer term, but such arguments meant little to business

services firms that had no need to deal with a broader public, and whose immediate circle of contacts already had the telephone.<sup>25</sup> In 1898, one Glasgow merchant who dealt primarily with wholesalers believed that all his contacts could afford the current system, and that broadening access would only overload the network further.<sup>26</sup>

Early telephone providers used flat rates mainly for administrative convenience, but became disturbed by the moral hazard of a system that encouraged large users to make great use of the network to the exclusion of others. Herbert Laws Webb, a prominent telephone engineer and commentator, equated flat rates with undercapitalised equipment and indifferent service, all characteristic of the initial ‘experimental period’ of telephone development that the United States, but not Europe, managed to outgrow in the 1890s.<sup>27</sup> The Canadian writer Herbert Casson observed that the flat rate system had proved satisfactory for small towns and farming regions, but that ‘in a great city such a plan grew to be suicidal’.<sup>28</sup> Following the example of some American exchange districts—Buffalo, NY, most notably—local NTC officials attempted to introduce a measured rate in Sheffield in 1892, but met fierce resistance from large users of the telephone who benefited from the flat rate. One firm complained that it would be charged £95 a year under the proposed measured rate, as opposed to £10 under the flat rate. Some smaller users also opposed the change, arguing that they preferred a predictable flat rate rather than a variable rate even if the latter was cheaper.<sup>29</sup>

This response from the lesser users among the Sheffield business classes seems to lend support to Lipartito’s point that widespread (and continuing) customer preference for bundled rates can appear irrational and may reflect broader cultural differences.<sup>30</sup> However, it is unclear from the Sheffield evidence how much of a premium firms were willing to pay for the convenience and predictability of flat rates, or, indeed, whether the flat rate was more expensive at all. The difference between the proposed rates in Sheffield in 1892 was only £3; at 1d. per extra call over an initial 1,000, any firm making six calls per working day would have been better off with the flat rate. Had the flat rate been £50 instead of £10—still a fraction of the telephone’s worth to the larger users—lesser users would presumably have supported the measured or even the message rate. The differentials between rates, and their implications for user choices, need to be analysed in more detail before conclusions can be drawn about wider cultural preferences for bundled or itemised charging regimes in the British case.

Early British flat rates were undoubtedly too high for most domestic users, but were hardly onerous to many businesses. Some of the firms that cited cost as a reason for not subscribing seem far from marginal. One Glasgow commission agent argued that he would benefit greatly from the telephone, and would subscribe at a rate of £5, but could not justify the £10 charge; he had 400 open accounts with retailers across the city and frequent communication with those customers and with commercial travellers. A lawyer, who also wanted to pay no more than £5, employed two clerks and an office boy, so the telephone, even at £10, would have been a small expense in relation to his wage bill alone.<sup>31</sup> Firms in the shipping industry that made heavy use of trunk and local lines alike already paid large sums for the telephone. James Gardner & Co. and George Gibson & Co., Glasgow shipbroking firms that shared the same managing clerk, spent £340 a year on telephone subscriptions and trunk call charges in the 1890s, and believed they got value for money.<sup>32</sup>

The overall picture, therefore, is of a technology that was quickly adopted by business, but with continuing uncertainty over technological capabilities, charging regimes and the political and administrative environment. Adoption, however, is much easier to assess than use: what exactly the telephone was used for, and its effect on office practice and business culture, remains much less clear. The flat rate system meant that the telephone companies kept no systematic evidence for the calls made by their customers that would facilitate the reconstruction of call patterns in any detail. Equally, firms had no

reason to log their use of the telephone. Even in the long-distance system, which did charge individual calls, little firm-level evidence survives.

These questions must be approached by seeking less direct evidence, and this article draws heavily on testimony given to Parliamentary enquiries into the telephone service during the 1890s. These were convened against a background of sustained criticism of the NTC lasting for more than a decade, both from users and from some city councils that wanted to create their own municipal networks. In addition, there was widespread disquiet about the eventual intentions of the Post Office, given that the NTC's licenses were due to expire in 1911, and that extended planning blight seemed characteristic of the industry. In such a charged political atmosphere, much of the evidence given to Parliament, and that appearing in the letters columns of newspapers, has to be viewed with caution. For the purposes of this article, however, many witnesses incidentally offered unique testimony of their day-by-day use of the telephone, and it is that element that underpins much of the argument in the following sections.

## II

As with most business communications technologies, the telephone raised questions about the boundaries of the firm and about the management of internal and external information flows. The telephone was initially marketed as a means of improving communications within the firm, and this remains an important function. The development of exchange technology enabled communications between firms, but also added a new dimension to internal company systems, because owners and managers could call the office and give direct orders from anywhere on the network.

At the very beginning, while exchange systems remained experimental and geographically limited, direct private-wire connections were the mainstay of the telephone companies' marketing efforts. Firms operating on large or dispersed sites could improve their internal links with telephones, as could businesses that were in the transport and communications field themselves. In the 1840s and 1850s, the railways had famously adopted the telegraph as a natural complement to their own network, and telephones in turn were attractive to the transport sector. Tramway, cab and omnibus companies in larger cities linked stables and local depots to one another, and to a central office for administration and, eventually, for taking bookings from the public. One Glasgow cab firm reckoned it used 200 miles of telephone wire across the city in 1894. It called all its offices every morning at 8am to ensure that the lines were working (and, presumably, to check that staff were at work).<sup>33</sup> Dock estates were among the largest sites under a single management in the later nineteenth century. The Clyde Navigation Trust had telephones in all of its dock facilities on both sides of the river, at its building and maintenance works (7 miles away at Dalmuir near Clydebank), and in its offices at Robertson Street in Glasgow.<sup>34</sup>

Private point-to-point wires connected offices to warehouses, and offices to homes. In Liverpool, the *Daily Post* connected its office in Lord Street to the home of its editor, half a mile away in Bedford Street North. Across the river, Birkenhead entrepreneur John Laird installed a line from his home in Hamilton Square to his iron works.<sup>35</sup> From the very beginning of the telephone era, promoters saw home-to-office connections as an important selling point for the wealthier business classes, especially those living in more distant suburbs:

The merchant sitting in his house at Chiselhurst or at Harrow can, with telephonic communication between his study or his bedroom and his City office, receive full reports of the day's business as often as occasion may arise... To a busy man, the possibility of remaining away from town without neglecting his affairs is a

valuable consideration. Elderly men wishing to take life more easily may be consoled that the time is at hand when indispensable mental exertion will be unattended by the necessity for excessive physical effort.<sup>36</sup>

After exchange systems became widespread, firms often acquired an exchange connection at their office, but maintained private wires to branches and works. Table 2 collates the numbers of instruments and the type of lines used by a selection of Glasgow firms: this evidence emerges incidentally from testimony to the 1898 enquiry into the city's telephones, and includes firms that explicitly stated the nature of their telephone connections. Although the adoption rates of exchange lines can be traced in telephone directories, fragments like this are the only surviving record of private wire and internal extension usage, and it is clear that private wires remained an important element of the telephone system after the spread of exchanges.

Private-wire systems restricted telephone contact beyond the boundaries of the firm, ensuring that branch offices could only communicate with the central office, and, obviously, that no one from outside the company could call them directly. It is unclear, however, whether this was a deliberate attempt to control information flows, or a by-product of technical limitations. Some firms installed exchange lines in their branches and warehouses when they first became available in the 1880s, but then reverted to private wires because they were more reliable. Delays and faults on the exchange system meant that firms were embarrassed by not being able to communicate customers' orders between sites immediately: the customer might struggle to get through to the main office in the first place, but at least with private wires the subsequent communication within the company concerning that order would be faster.<sup>37</sup> In a different context, London Stock Exchange members had reverted to dedicated private wires to the provinces by 1900, in pursuit of reliable service for their huge call-volumes.<sup>38</sup>

Exchange systems offered a radical shift to communication beyond the boundaries of the firm. Still, much use of them remained internal in the administrative sense, consisting of managers calling in with orders and employees reporting back to the office. The initial idea that businessmen would use telephones to manage their offices from a distance remained important, although limited to a select few. In 1895, the NTC surveyed 348 London subscribers who had both domestic and business lines, and found that the leading groups were merchants (80), manufacturers (39), stock brokers (38), newspaper staff (21) and solicitors (20): between them, they accounted for more than half of such cases, leaving a long tail of lesser traders, retailers and professionals in small numbers. Evidently, very few in the latter categories had the resources or inclination to manage their firms from a distance.<sup>39</sup>

Although initially restricted by Post Office rules designed to protect telegraph revenues, telephone companies installed 'call offices', available either for a charge or to existing telephone subscribers on production of a company token, and one of their most common uses was in reporting from the field. In commercial cities, the various commodity and shipping exchanges were crucial nodes for information transfer: when they installed telephones, it would become possible to 'have all the advantages of being in one's own office and on 'Change at the same time', predicted one early enthusiast.<sup>40</sup> Routine information that fed into company decision-making did indeed come to be updated many times during trading sessions, and shipbrokers' charter clerks, for example, called their offices with the latest freight rates being quoted on the Glasgow Exchange.<sup>41</sup>

Call offices were also in great demand at key transport locations. In Liverpool, call offices at the docks earned £50 a year in 1910, against an average of £14; only the railway station call offices raised similar revenue.<sup>42</sup> Telephones brought a dramatic improvement in communications on dispersed sites like dock estates. In 1884, Liverpool's Chamber of Commerce complained that commercial clerks had to spend a good deal of time at the docks, and that they were effectively out of touch for long

periods: although they could send messengers back to their city-centre offices, this was not always a fast or reliable method.<sup>43</sup> Indeed, the telephone companies targeted the alleged inadequacies of messengers in their advertising. Pictured reading newspapers or watching ships in the harbour, they featured in leaflets headed ‘The telephone service is the quickest messenger’.<sup>44</sup>

Internal company communications remained a priority even over longer distances. A few firms installed their own private wires into the hinterland, such as that stretching about 12 miles between the Glasgow offices and Motherwell iron works of David Collville & Sons, and used them intensively enough to justify the installation expense.<sup>45</sup> Some of the first inter-urban network lines were sold to customers as a means of improving communications between branches, extending the quasi-internal role of the telephone. The Post Office agent targeted cotton-broking firms with offices in both Liverpool and Manchester when attempting to raise enough support for a trunk line between the two cities in 1881. At that point, the Lancashire & Cheshire Telephonic Co. had six subscribers willing to pay £240 a year for use of the line between the two cities; that was equivalent to the cost of employing two or three clerks, so a small minority of firms was clearly doing a very large regional telephone business virtually from the beginning of the service.<sup>46</sup>

Commercial centres acted as telephonic focal points, often showing a net ‘import’ of calls from their adjacent areas. Table 3 summarises statistics collected by the NTC in 1898.<sup>47</sup> Newcastle and Sunderland served as office and administrative centres for shipbuilding, coal-mining and related industrial clusters, and had particularly high ratios of inward to outward junction calls (that is, calls from neighbouring exchange areas: this was an intermediate level between local calls and calls on the long-distance trunk system). The Liverpool evidence is even more explicit, with the neighbouring exchanges of Birkenhead and Bootle having very high ‘export’ levels. In addition, the Birkenhead and Bootle exchanges handled very few local calls within their own boundaries, suggesting that there was little office-to-office communication within those districts: most of their traffic was with Liverpool. Birkenhead only had sixty-seven telephone subscribers in 1884, but that figure doubled the following year when a telephone cable to Liverpool was installed through the Mersey rail tunnel.<sup>48</sup> The imbalance of inward and outward calls suggests that branch offices, employees working away from the office, managers living in the suburbs, and firms based in the dock and factory districts were more likely to initiate calls to firms in the central business district than vice versa.

Exchange systems also enabled truly external telephone use, beyond the administrative (as well as the physical) boundaries of the firm, but analysis of such usage poses major evidential problems. As has been noted, neither the telephone companies nor individual firms kept systematic records that enable the reconstruction of telephone use patterns, but some illustrative material survives. Table 4 summarises the testimony given by firms at the enquiry into the Glasgow telephone service in 1898. This selection of business-to-business telephone use provides some evidence of vertical communication, with firms tending to call those immediately above or below them in the trading chain.

Using exchange wires raised the issue of confidentiality, which along with reliability problems emerges as one of the main drawbacks of the early networks. One common complaint in the 1890s was that exchange operators were cavalier about putting calls through: conversations were interrupted and privacy threatened if the third parties were also interested in the discussion that was taking place.<sup>49</sup> This was a particular hazard for those working in brokering roles, because they might have to conduct separate negotiations with several parties in the course of completing a single deal, and could not reveal any of these discussions to any of the others. One Glasgow shipbroker complained that he might be fixing a cargo with a shipowner when the merchant in question tried to call, and was put on the line as well. He had reverted to sending written offers by messenger when confidentiality was particularly important.<sup>50</sup>



The shipping industry—a sector with an obvious need for remote communications—offers useful evidence for the telephonic ‘reach’ of firms. By the end of the nineteenth century, some firms were using telephones to manage coastal trades where activity at several stopping points along a route required co-ordination. Aberdeen, for example, was a hub for coastal shipping between southern and northern Scotland, and firms based there were active users of the longer-distance lines to their branches, agents and customers in Leith.<sup>51</sup> In this sector, the ‘just-in-time’ capacities of the telephone quickly became indispensable. One Glasgow shipbroker complained in 1897 that he had tried to tell his agent at Bowling, ten miles down the Clyde, to stop a vessel from proceeding to Glasgow, but had lost the connection; by the time he was able to telegraph instead, the vessel had passed, and had to be turned round subsequently.<sup>52</sup> As ever, though, individual firms made individual choices. The London office of Turnbulls, a leading Whitby shipping firm, seems to have used the trunk line sparingly, preferring to send telegrams; it was more important to them to have a local telephone line to the Baltic Exchange, where their coal charters would be settled on a daily basis.<sup>53</sup>

If patterns of use were widely varied, volumes of use were even more so. The early telephone providers saw that the system was developing in a very polarised manner, and struggled to balance the demands of different customers: ‘they knew that large firms were telephoning all day, whilst a man in a small way of business made one or two calls per day’.<sup>54</sup> Even in 1913, it was calculated that around one third of all subscribers made fewer than 500 calls in a year, although by then some of those would have been domestic lines.<sup>55</sup> As will be seen, some business users were already making that number of calls in a week during the 1890s.

In the flat rate era, managers and owners neither knew nor cared how often the machine was used in the office.<sup>56</sup> Even after the introduction of the measured rate for some firms in 1907, there is no systematic record of call volumes at the level of individual users, although subscribers often complained to the press of apparent errors in their bills.<sup>57</sup> Indirect evidence is available, however. Exchange managers were instructed to monitor the largest users of the system, and this informed the telephone companies’ sales strategy: firms with lines that were often engaged were urged to take a second line or a switchboard of their own, to ensure that their callers got through. Telephone companies sometimes recorded the names of the frustrated callers and passed this information to the engaged firms, in order to strengthen their argument about lost business, although no lists of firms dealt with this way appear to survive.<sup>58</sup>

The allegation that some numbers were constantly engaged was among the most common complaints about the early systems. Contemporaries found it hard to believe, but the largest firms did make and receive so many calls by the late 1890s that their machines were always in use. According to the chief operator in Glasgow, the firms of P. & W. MacLellan (Clutha Iron Works), the Caledonian Railway Co., the Allan Line (steamship owners) and the Clyde Shipping Co. could ‘very seldom’ be reached without a lengthy wait. The Caledonian Railway Co., which had just one telephone line, made 112 calls between 9am and 6pm on what was claimed to be a typical day, at a time when even fifty calls was considered heavy use.<sup>59</sup> Calls were not distributed evenly across the day in British commercial centres, and there were peaks around 11am and 3-4pm.<sup>60</sup> Even assuming a uniform distribution, however, the Caledonian made just over one outgoing call every five minutes, plus an unspecified number of incoming calls: assuming call-durations of even two minutes, the telephone would indeed have been constantly in use. Other firms had lower phone usage, but evidently spent a disproportionate amount of time failing to get through to the large companies with which they did business. One Glasgow shipbroker tried to make nineteen calls in twelve minutes, and found nine numbers engaged; he stated that it was a busy time and that many of the lines were those of large firms.<sup>61</sup>

Firms acquiring more than one line were therefore likely to be heavy users, so analysis of firms having multiple numbers in local telephone directories can offer an indication of volume of use. By 1906, Liverpool telephone officials reported that 120 firms had adopted additional numbers, following a campaign by the NTC persuading heavy users to increase their capacity.<sup>62</sup> It is clear from contemporary complaints, however, that some firms with only one line were equally heavy users—they were just more resistant to paying for additional lines.<sup>63</sup> In 1920, a Whitehall committee investigating the system recommended that the Post Office should refuse service to anyone whose engaged calls exceeded 25% of successful incoming calls, and who refused to rent an additional line; that was still a considerable proportion and suggests a persistent attitude on the part of some businesses.<sup>64</sup>

The matter is complicated by evidence that some firms neglected incoming calls, apparently not believing that failure to handle these might result in lost business. NTC staff in Liverpool remonstrated in 1907 with ‘the Secretary of one of our largest shipping firms’, who was ordering his operator to give preference to internal extension calls. In other respects, that firm was well advanced: it had a private switchboard, and employed a (female) operator specifically to work it. Nonetheless, it remained ‘not very solicitous’ about incoming messages.<sup>65</sup> Other firms tried to use their relative power in the business hierarchy to limit the number of incoming calls they received. One Glasgow biscuit-maker ordered commercial travellers not to contact him by telephone, insisting that they come to the office in person.<sup>66</sup>

The Liverpool section of the 1899 NTC directory lists fifty-two firms with a second line for the operator to use if the first was engaged, and this is some reflection of the type of firms that were particularly active users.<sup>67</sup> Classifying these firms by sector reveals a preponderance of agents, brokers, wholesalers and various firms in foodstuffs (table 5). The same directory also lists thirty-one firms which advertised that they had an extra ‘trunk-only’ line, perhaps an indicator of heavier use of the long-distance network. The great majority of these were in the transport, brokering and intermediary trades (table 6).

In long distance telephony, a few sectors are well known as early-adopters and heavy users, but evidence for its use by other kinds of business is fragmentary. Much of the traffic on the lines between London and provincial cities was believed to originate in stock exchanges, because stockbrokers found the system’s capacity for short, immediate messaging particularly suited to their information requirements.<sup>68</sup> Those advocating an expansion and liberalisation of the long-distance system often cited stock exchange or newspaper use, but tended not to give other examples, perhaps because there were few.<sup>69</sup> The Liverpool and Glasgow evidence, however, suggests that some members of the shipping trades ought to be added to the list of heavy trunk-line users. It is important to stress, however, that for many users, ‘long-distance’ may have stretched no further than the regional hinterlands of the major commercial centres, with their rapid spread of busy inter-urban lines.

By the end of the second decade of telephone development, therefore, a small proportion of firms had moved toward heavy use of the technology for local contacts, and an even smaller group had adopted long-distance communications; in both cases, firms in intermediary and service roles dominated the lists. Most users, including the great majority of firms working in those same trades, were much slower adopters of the system. In addition, a significant component in telephone use remained the speeding-up of communications within the boundaries of the firm, rather than the exploitation of its potential for connecting firms at a distance.

What, then, was the impact of the telephone on the office environment and culture of Victorian and Edwardian business? There were early fears that the telephone would further disrupt patterns of business life that were already under threat from various innovations, although some comments sound suspiciously like technophobic caricatures. For example, an 1879 editorial in *The Times* argued that businessmen who had once been able to organise their day's work after the arrival of the morning post were increasingly having to react to incoming telegraph messages, and now telephone calls, at any time.<sup>70</sup> Widening access to the telephone, it was feared, would increase the business expenses of the elite, who would have to employ more staff to filter calls.<sup>71</sup>

In fact, businessmen already had gate-keeping strategies to screen callers and incoming messages, and they extended these to the telephone. Whether to use the telephone personally, or to delegate it to a subordinate, quickly became just another element in the reinforcement of office hierarchies. Indeed, with nice irony, the Post Office's own trunk-line salesman could not get past the outer offices of leading Manchester firms to discuss the installation of a line to Liverpool in 1881, and presumably did not consider the matter appropriate for discussing over the telephone; the private offices of De Jersey & Co. and Reiss Bros, he complained, were as 'jealously guarded as if they were state prisons'.<sup>72</sup>

There was some disagreement over the effectiveness of telephone gate-keeping. One critic complained that he would be in a meeting with a lawyer or broker, who would break off from their conversation to talk with another client who had called on the telephone.<sup>73</sup> Some firms apparently either lacked the staff to screen calls, or were uncomfortable turning away clients, who had already come to expect instant access to their advisors by telephone. This seems to contradict the equally common complaint about neglect of incoming calls, although there might have been a difference in attitudes between business and the professions on this point. An alternative explanation, however, was that such interruptions were deliberate, and represented a clever use of the new technology to discourage loquacious clients from lingering in their lawyers' offices.<sup>74</sup>

If some businessmen saw the telephone as a threat to their time and self-determination, the telephone companies had little sympathy: 'The person who says he does not want to be rung up on the telephone, that he does not want to be at the beck and call of other people, and so forth, is usually a rather arbitrary person of somewhat old-fashioned ideas'.<sup>75</sup> Elite resistance was not, of course, incompatible with growing telephone use, provided that businessmen could be persuaded to adopt the technology and delegate its use to junior staff. In any case, owners and managers show widely varying attitudes toward personal use of the telephone.

There are many examples of senior business figures who made little use of the telephone, any more than they would have personally used the telegraph or carried a message. The mercantile classes gave great weight to face-to-face discussion, lowering the status of other forms of communication by default, and this encouraged the business elite to leave telephone use to their employees. 'Most of the business men in Glasgow give the message to a boy, and don't go to the telephone', claimed one of their number.<sup>76</sup> A grain merchant, for example, testified that he went to the telephone 'as seldom as possible', leaving it to his staff.<sup>77</sup> A Manchester solicitor reported that the telephone in his outer office was used constantly, but that his own desk instrument was only needed three or four times a day.<sup>78</sup> That individual was a member of the city council and the Ship Canal Company, so should have been part of influential local business and administrative networks; such connections were evidently not maintained by telephone at any level of detail. Businessmen did use the telephone to make their existing routines work more smoothly, by having office boys call to make appointments with their contacts, which they then attended in person.<sup>79</sup> Even in 1911, a visiting American telephone executive noted that English businessmen continued to call with 'Are you there?... I will be right over, I want to speak to you'.<sup>80</sup>

Although that anecdote was intended to satirise the quaint practices of English business, such practices were rational enough in elite circles where discussions were strategic rather than immediately time-sensitive. In sectors where a large volume of short, focused discussions took place involving relatively few variables, businessmen show a much higher level of personal engagement with the technology. Shipbrokers have already been mentioned, and the telephone radically speeded up their fixing of prices, volumes and dates, when compared to their previous practice of having to visit shipping and mercantile offices, or frequent the Exchange. Men in the coal trade often worked at the boundaries of production, wholesale and retail, with constant shipments and sales to handle: one Glasgow coal merchant, who was also a partner in hinterland colliery companies, claimed to ‘have almost lived on the telephone during business hours’.<sup>81</sup>

This question of who actually used the telephone had wide implications. Telephone companies argued that many ‘faults’ were caused by the failure of office boys to use the machinery properly, and some businessmen agreed.<sup>82</sup> Others argued that the ‘faults’ were more likely to be caused by the businessmen themselves, being relatively unused to the equipment.<sup>83</sup> The solution was to employ trained, dedicated telephone-answering staff, but even large firms resisted this. At the Glasgow Railway Engineering Works, office boys, junior clerks, senior clerks and the chief clerk all attended the phone.<sup>84</sup> The Clyde Navigation Trust did employ a commissionaire to work its own switchboard, but that was not common practice.<sup>85</sup> In ‘thousands of offices’, claimed one of the NTC’s Liverpool staff in 1907, the office boy had to master the private branch exchange, and in his frequent absence on other duties, this task would devolve to the nearest clerk: this practical problems added to the issue of incoming calls being handled in a rather random manner. That said, only two per cent of calls were not answered at all, suggesting that almost all offices developed some system for answering the phone.<sup>86</sup>

There is also evidence that office workers rapidly adopted the telephone for personal use, especially in the era of the flat-rate system. If senior businessmen shunned the telephone, their junior employees allegedly embraced it. When, in the early twentieth century, measured rates were introduced, many firms were shocked by how many calls they were charged for. Herbert Laws Webb argued that ‘the “telephone habit” has so spread to all classes of the community that a large amount of private use of the telephone goes on in many business establishments’. Discussing sport, conducting love-affairs, and placing bets had all become traditional, it was alleged, and would not be wiped out in a hurry just because each call was now billed.<sup>87</sup>

As early as 1886, there had been complaints that cricket matches in Manchester generated considerable telephone traffic across the North West as office workers called their local exchange to get the latest scores, although which rank of worker did this is unclear.<sup>88</sup> Given the scarcity of domestic telephones even at the most elite levels, illicit use of the office telephone to contact people working in other offices would have been the most common means for the clerical classes to use the technology. The rapidity with which lower-status office workers lost access to telephones when call-metering was introduced is unclear, but in the longer term the ability to make external calls without seeking permission became an indicator of an individual’s place in the office hierarchy.

Those working close to, but not at, the top of large companies also seem to have adopted the telephone more enthusiastically than the partners and owners themselves. Managers, accountants and company secretaries are more visible in the sources personally using the technology. Revealingly, though, such people saw routine use of the telephone as isolating them from their peers, and they made attempts to encourage face-to-face meetings. The President of the North East Coast Association of Secretaries (that is, Company Secretaries, not clerical workers) told his members that before the Association was formed in 1905, they had

a mere telephonic acquaintance. They knew each others' voices only; their faces were unknown to each other, they might transact over the telephone very important business...and meet next day in the train as perfect strangers. All that was now happily changed. Through their Association they had met and become acquainted, he believed, to their mutual benefit.<sup>89</sup>

Company Secretaries were still in the process of becoming a managerial, professional group with standards of their own, and would undoubtedly have formed associations in any case. Such an explicit statement about the use of the telephone by a senior occupational group is rare in this period, however. Raising the status of the group required the creation of face-to-face, personal business connections of the sort long-practiced by their superiors. In the process, the managers sought to distance themselves from the routine telephone interactions that made their jobs easier, but which clearly had negative implications for their status on the corporate ladder.

#### IV

Many of the issues faced by business in accommodating the telephone were revisited repeatedly in the twentieth century as successive new technologies were developed, and even some of the most recent are beginning to attract the attention of historians.<sup>90</sup> Each new telecommunications invention tends to be hailed as a global, world-shrinking device, but the local orientation of early telephone systems is a useful reminder that many adoption decisions are taken in a narrower compass. The widespread early use of the telephone for speeding internal company communications reinforces the importance of this dimension, as does its gradual (and only gradual) displacement of some existing communications techniques and technologies.

The relative lack of engagement with the telephone on the part of senior businessmen is an important example of the persistence of face-to-face networking and communications within business culture, especially given recent work on the centrality of such information exchange to the functioning of commercial centres.<sup>91</sup> At the same time, many categories of business information were entrusted to the telephone from an early date, and the evidence presented in this paper suggests that shipbroking and other intermediary firms might be fruitful subjects for research into the effect of telecommunications on productivity in the late nineteenth century. A better grasp of the complicated patterns of adoption and use of the telephone by British business should lead to a more subtle classification and understanding of different kinds of business information, and of varying strategies for its exchange and circulation.

#### Acknowledgements

I am very grateful to my colleagues in Liverpool, and to delegates attending the Cross Connexions conference at the Science Museum in November 2005, for their comments and encouragement; to Ray Martin for help at BT Archives, London; and to the Leverhulme Trust for funding the Mercantile Liverpool Project, of which this research is part.

#### References

Baldwin, F. G. C. *The History of the Telephone in the United Kingdom*. London: Chapman and Hall, 1925.

- Casson, Herbert N. *The History of the Telephone*. Chicago: McClurg, 1910.
- Coopersmith, Jonathan. "Creating the Commons: Establishing a Civic Space for a New Form of Communications." *Business and Economic History* 28 (1999): 115-124.
- Fischer, Claude S. "Technology's Retreat: The Decline of Rural Telephony in the United States, 1920-1940." *Social Science History* 11 (1987): 295-327.
- . "'Touch Someone': The Telephone Industry Discovers Sociability." *Technology and Culture* 29 (1988): 32-61.
- . *America Calling: A Social History of the Telephone to 1940*. Berkeley: University of California Press, 1992.
- Galambos, Louis. "Theodore N. Vail and the Role of Innovation in the Modern Bell System." *Business History Review* 66 (1992): 95-126.
- Garnet, Robert W. *The Telephone Enterprise: The Evolution of the Bell System's Horizontal Structure, 1876-1909*. Baltimore: Johns Hopkins University Press, 1985.
- Green, Venus. "Race, Gender and National Identity in the American and British Telephone Industries." *International Journal of Social History* 46 (2001): 185-205.
- Hibbard, Angus. *Hello, Goodbye: My Story of Telephone Pioneering*. Chicago: McClurg, 1941.
- Hochfelder, David. "A Comparison of the Postal Telegraph Movement in Great Britain and the United States, 1866-1900." *Enterprise and Society* 1 (2000): 739-761.
- Holcombe, A. N. "The Telephone in Great Britain," *Quarterly Journal of Economics* 21 (1906): 96-135.
- Langdale, John V. "The Growth of Long-Distance Telephony in the Bell System: 1875-1907." *Journal of Historical Geography* 4 (1978): 145-159.
- Lipartito, Kenneth. *The Bell System and Regional Business: The Telephone in the South, 1877-1920*. Baltimore: Johns Hopkins University Press, 1989.
- . "When Women Were Switches: Technology, Work and Gender in the Telephone Industry, 1890-1920." *American History Review* 99 (1994): 1,074-1,111.
- . "Culture and the Practice of Business History." *Business and Economic History* 24 (1995): 1-41.
- Long, Anne, and Russell Long. *A Shipping Venture: Turnbull Scott & Co., 1872-1972*. London: Hutchinson, 1974.
- Martin, Michèle. "Communication and Social Forms: The Development of the Telephone, 1876-1920." *Antipode* 23 (1991): 307-333.
- . *"Hello, Central?" Gender, Technology and Culture in the Formation of Telephone Systems*. Montreal: McGill University Press, 1991.
- Marvin, Carolyn. *When Old Technologies were New: Thinking About Electric Communication in the late Nineteenth Century*. Oxford: Oxford University Press, 1998.
- Michie, R. C. "The London Stock Exchange and the British Securities Market, 1850-1914." *Economic History Review* 38 (1985): 61-82.
- Milne, Graeme J. "Knowledge, Communications and the Information Order in Nineteenth-Century Liverpool." *International Journal of Maritime History* 14 (2002): 209-224.

- Mueller, Milton. "The Switchboard Problem: Scale, Signaling and Organization in Manual Telephone Switching, 1877-1897." *Technology and Culture* 30 (1989): 534-560.
- Perry, Charles R. "The British Experience 1876-1912: The Impact of the Telephone During the Years of Delay." In *The Social Impact of the Telephone*, edited by Ithiel de Sola Pool. Cambridge, MA: MIT Press, 1977: 69-96.
- Pike, Robert M. "Kingston Adopts the Telephone: The Social Diffusion and Use of the Telephone in Urban Central Canada, 1976-1914." *Urban History Review* 18 (1989): 32-47.
- Pool, Ithiel de Sola. *The Social Impact of the Telephone*. Cambridge, MA: MIT Press, 1977.
- Roberts, Stan. *The First Hundred Years of the Telephone Service in the Liverpool Telephone Area*. Liverpool: British Telecom, 1981.
- Robertson, J. H., *The Story of the Telephone*. London: Pitman, 1947.
- Robson, Brian T. *Urban Growth: An Approach*. London: Methuen, 1973.
- Simon, Curtis J. and Clark Nardinelli. "The Talk of the Town: Human Capital, Information, and the Growth of English Cities, 1861 to 1961." *Explorations in Economic History* 33 (1996): 384-413.
- Smith, George David. *The Anatomy of a Business Strategy: Bell, Western Electric, and the Origins of the American Telephone Industry*. Baltimore: Johns Hopkins University Press, 1985.
- Stein, Jeremy Leon. "Ideology and the Telephone: The Social Reception of a Technology, London, 1876-1920." Ph.D. thesis, University College London, 1996.
- Stenhouse, David. "The Locational Behaviour of Liverpool Offices, 1875-1970." Ph.D. thesis, University of Liverpool, 1981.
- Wallsten, Scott. "Returning to Victorian Competition, Ownership, and Regulation: An Empirical Study of European Telecommunications at the Turn of the Twentieth Century." *Journal of Economic History* 65 (2005): 693-722.
- Wasserman, Neil W. *From Invention to Innovation: Long-Distance Telephone Transmission at the Turn of the Century*. Baltimore: Johns Hopkins University Press, 1985.
- Webb, Herbert Laws. *The Development of the Telephone in Europe*. London: Electrical Press, 1911.
- Yates, JoAnne. *Control Through Communication: The Rise of System in American Management*. Baltimore: Johns Hopkins University Press, 1989.

---

<sup>1</sup> Lipartito, *The Bell System and Regional Business*; Wasserman, *From Invention to Innovation*; Smith, George David. *The Anatomy of a Business Strategy*; Garnet, *The Telephone Enterprise*; Galambos, "Theodore N. Vail."

<sup>2</sup> Mueller, "The Switchboard Problem"; Baldwin, *History of the Telephone*.

---

<sup>3</sup> Green, “Race, Gender and National Identity”; Lipartito, “When Women Were Switches.”

<sup>4</sup> Langdale, “The Growth of Long-Distance Telephony”; Robson, *Urban Growth*, 165-177; Wallsten, “Returning to Victorian Competition.”

<sup>5</sup> Perry, “The British Experience 1876-1912”; Holcombe, “The Telephone in Great Britain.”

<sup>6</sup> Fischer, “Technology’s Retreat.”

<sup>7</sup> Fischer, “Touch Someone”; Fischer, *America Calling*.

<sup>8</sup> Pike, “Kingston Adopts the Telephone”; Martin, “Hello, Central?”; Stein, “Ideology and the Telephone.”

<sup>9</sup> Yates, *Control Through Communication*.

<sup>10</sup> Baldwin, *History of the Telephone*, 96.

<sup>11</sup> Robertson, *The Story of the Telephone*, 29.

<sup>12</sup> UK Parliament. Report from the Select Committee on the Telephones. 1898 XII 383 (hereafter *Telephones 1898*), report.

<sup>13</sup> Hann, T. “Pioneer Work and Development of the Telephone Service in the North Eastern District of England.” Typescript, 1938, Tyne & Wear Archives, Newcastle upon Tyne, PA646; Baldwin, *History of the Telephone*, 472-477; Roberts, *The First Hundred Years*.

<sup>14</sup> UK Parliament. Report from the Select Committee on the Telephone Service. 1895 XIII 350 (hereafter *Telephone Service 1895*), evidence of James Staats Forbes, q.4,360.

<sup>15</sup> Webb, *The Development of the Telephone in Europe*.

<sup>16</sup> Telephone Service 1895, evidence of James Staats Forbes, q.4,372; Perry, “The British Experience 1876-1912,” 75.

<sup>17</sup> Hochfelder, “A Comparison of the Postal Telegraph Movement,” 745.

<sup>18</sup> Holcombe, “The Telephone in Great Britain,” 103.



- 
- <sup>19</sup> UK Parliament. Report to the Treasury into the Telephone Exchange System in Glasgow. 1898 XLIV C-8768 (hereafter Glasgow 1898), report.
- <sup>20</sup> Martin, “Communication and Social Forms.”
- <sup>21</sup> Telephone Service 1895, evidence of James Staats Forbes, qq.4,387-4,391.
- <sup>22</sup> UK Parliament. Departmental Committee on Telephone Rates. 1920, XXV, Cmd. 804 (hereafter Departmental Committee 1920), 13. This source also surveys the history of British telephone tariffs.
- <sup>23</sup> *The Times*, 29 Mar. 1899, 7, letter from C. E. Webber.
- <sup>24</sup> Departmental Committee 1920, 25.
- <sup>25</sup> Glasgow 1898, evidence of Alfred Bennett, q.5,942; Perry, “The British Experience 1876-1912,” 92.
- <sup>26</sup> Glasgow 1898, evidence of Andrew Jackson Kirkpatrick, qq.9,092-9,094.
- <sup>27</sup> Webb, *The Development of the Telephone in Europe*, 16-17.
- <sup>28</sup> Casson, *History of the Telephone*, 178.
- <sup>29</sup> Hibbard, *Hello, Goodbye*, 160; Telephones 1898, qq.4,714-33.
- <sup>30</sup> Lipartito, “Culture and the Practice of Business History,” 32.
- <sup>31</sup> Glasgow 1898, qq.6,062-6,080 (commission agent); q.6,047 (lawyer).
- <sup>32</sup> Glasgow 1898, q.8,990.
- <sup>33</sup> Telephone Service 1895, evidence of Robert Kay, q.2,171.
- <sup>34</sup> Glasgow 1898, evidence of Robert White, qq.2,844-2,912.
- <sup>35</sup> Roberts, *The First Hundred Years*, 7.
- <sup>36</sup> *The Times*, 10 May 1879, 6, letter from Arnold White, manager of the Edison Co., London.
- <sup>37</sup> Glasgow 1898, evidence of Alexander Wood, q.3,329.
- <sup>38</sup> Michie, “The London Stock Exchange,” 71.

---

<sup>39</sup> BT Archives, POST 84/124, Subscribers having private house lines and business connections, May 1895.

<sup>40</sup> From the president's opening address, *Proceedings of the Liverpool Architectural Society* (1879-80): 10.

<sup>41</sup> Glasgow 1898, evidence of John Muir Paton, q.267.

<sup>42</sup> BT Archives, POST 84/126, Papers to be discussed at meeting of officers, June 1910, paper by E. J. Hidden.

<sup>43</sup> Stenhouse, "The Locational Behaviour of Liverpool Offices," 267.

<sup>44</sup> BT Archives, POST 84/125A, item no. 9; POST 84/125B, item no. 66.

<sup>45</sup> Glasgow 1898, evidence of Archibald Colville, q.8,895.

<sup>46</sup> BT Archives, POST 30/401B.

<sup>47</sup> BT Archives, POST 84/122, exchange statistics, Sept. 1898.

<sup>48</sup> Roberts, *The First Hundred Years*, 26.

<sup>49</sup> Telephone Service 1895, evidence of Samuel Chisholm, q.430.

<sup>50</sup> Glasgow 1898, evidence of John Muir Paton, qq.265, 358.

<sup>51</sup> Telephone Service 1895, evidence of George Bisset, q.1,094.

<sup>52</sup> Glasgow 1898, evidence of John Muir Paton, q.238.

<sup>53</sup> Long and Long, *A Shipping Venture*, 155.

<sup>54</sup> *The Times*, 31 Aug. 1907, 5, A. M. Ogilvie, Post Office.

<sup>55</sup> Departmental Committee 1920, 14.

<sup>56</sup> Glasgow 1898, evidence of Anton Kufeke, q. 150.

<sup>57</sup> *The Times*, 29 Oct. 1907, 7.

<sup>58</sup> BT Archives, POST 84/126, meeting of contract agents, May 1906, 70.

<sup>59</sup> Glasgow 1898, evidence of Wilhelmina MacFarlane, qq.6,705, 6,711.

<sup>60</sup> Telephone Service 1895, evidence of William Preece, q.2,658.

<sup>61</sup> Glasgow 1898, evidence of David Anderson, q.9,007.

- 
- <sup>62</sup> BT Archives, POST 84/126, meeting of contract agents, May 1906, 76.
- <sup>63</sup> *Economist*, 22 Feb. 1908, 391.
- <sup>64</sup> Departmental Committee 1920, 29.
- <sup>65</sup> BT Archives, POST 84/126, Papers to be discussed at meeting of officers, June 1907, paper by E. S. Francis.
- <sup>66</sup> Glasgow 1898, evidence of John Woodside, q.1,732.
- <sup>67</sup> National Telephone Co., List of subscribers, 1899-1900, Liverpool Record Office, Hq 384.6025 NAT.
- <sup>68</sup> Michie, "The London Stock Exchange," 70.
- <sup>69</sup> Telephone Service 1895, evidence of Harcourt Clare, q.1,224; Glasgow 1898, evidence of John Yuille, q.8,863.
- <sup>70</sup> *The Times*, 10 May 1879, 11.
- <sup>71</sup> Marvin, *When Old Technologies were New*, 104.
- <sup>72</sup> BT Archives, POST 30/401B, letter from Colin Brodie, 13 Mar. 1881.
- <sup>73</sup> *The Times*, 27 Dec. 1905, 7, editorial.
- <sup>74</sup> *The Times*, 19 Jan. 1906, 4, letter from Herbert Laws Webb.
- <sup>75</sup> BT Archives, POST 84/130, Commercial handbook, 1906.
- <sup>76</sup> Glasgow 1898, evidence of D.M. Stevenson, q.4,764.
- <sup>77</sup> Glasgow 1898, evidence of David Clarkson, q.805.
- <sup>78</sup> Glasgow 1898, evidence of William Vandray, q.4,820.
- <sup>79</sup> Glasgow 1898, evidence of Alexander Rutherford, q.1,000.
- <sup>80</sup> Hibbard, *Hello, Goodbye*, 236.
- <sup>81</sup> Telephone Service 1895, evidence of John Dow, q.2,109.
- <sup>82</sup> Glasgow 1898, evidence of D. M. Stephenson, q.4,765.
- <sup>83</sup> Glasgow 1898, evidence of John Youlle, q.8,815.
- <sup>84</sup> Glasgow 1898, evidence of William Ferrier, q.2,506.

---

<sup>85</sup> Glasgow 1898, evidence of Robert White, q.2,857.

<sup>86</sup> BT Archives, POST 84/126, Papers to be discussed at meeting of officers, June 1907, paper by E. S. Francis.

<sup>87</sup> *The Times*, 2 Nov. 1907, 6, letter from Herbert Laws Webb.

<sup>88</sup> Roberts, *The First Hundred Years*, 25.

<sup>89</sup> 'President's Address', *Journal of the North East Coast Association of Secretaries*, 1, no. 4 (May 1907): 111.

<sup>90</sup> On fax machines, for example, see Coopersmith, 'Creating the Commons.'

<sup>91</sup> Simon and Nardinelli, 'The Talk of the Town'; Milne, 'Knowledge, Communications and the Information Order.'