Private telegraphy:

The path from private wires to subscriber lines in Victorian Britain

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The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

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Abstract

In this thesis, I investigate private telegraphy from its rise in the late 1830s to the advent of exchange telephony in the early 1880s. In contrast to public telegraphy where telegrams were transmitted over a shared network infrastructure, private telegraphy was a direct, more immediate form of user-to-user communication delivered over private wires. My objective is to redress a historiographical distortion in the understanding of the Victorian telegraph created by the conflation of the concept of telegraph with telegram, and by the prominence given to the nationalisation of the telegraph industry in 1870 in the discourse of historians like Jeffrey Kieve or Charles Perry, thus obscuring the critical role played by private telegraphy in the history of communication.

To begin with, I expose the dichotomy between public and private telegraphy by demonstrating the similarities and rivalry between telegrams and letters. I contend that this rivalry was an important factor behind the nationalisation. The extent to which private telegraphy was distinct from public telegraphy is demonstrated through a comprehensive history of private wires and the first domestic telegraph instruments. I track the development of private wires, from their inception at the hands of users of the telegraph to their assimilation by telephony, and show their versatility for diverse uses. I also reveal how telegraphic intercommunication systems – the so-called Umschalters – were reconfigured to become the Post Office’s first generation of telephone exchanges in the early 1880s. From this novel perspective, I counter the received scholarly view that the Post Office obstructed the expansion of telephony to protect the Crown’s stake in telegraphy. I claim instead that the Post Office exploited the installed

base of Umschalters and private wires, by then referred to as subscriber lines, to become an active participant in the nascent telephone industry alongside the private companies, thus accelerating the take-up of exchange telephony.

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Abbreviations and acronyms

- ADT – American District Telegraph Company.
- BPMA – British Postal Museum & Archive.
- ETC – Electric Telegraph Company, also known as the 'Electric', and its later incarnation as the Electric & International Telegraph Company following its merger with the International Electric Company in 1855.
- GSTC – Gold and Stock Telegraph Company.
- GWR – Great Western Railway Company.
- LDTC – London District Telegraph Company, also called the 'District'.
- MTC – English & Irish Magnetic Telegraph Company, earlier known as the Magnetic Telegraph Company, or the 'Magnetic', was established in 1851. It merged with the British Electric Telegraph Company in 1857 to form the British & Irish Magnetic Telegraph company.
- NTC – National Telephone Company.
- UKTC – United Kingdom Electric Telegraph Company, also known as the 'United Kingdom' or the 'Shilling' company.
- UPTC – Universal Private Telegraph Company, also known as the 'Universal'.
- UTC – United Telephone Company.

Chapter 1. Introduction

> A dial instrument—a telegraph, that is, provided with alphabets engraved on a circular dial, and an index made to revolve and point to any required letter is more simple. Several such telegraphs exist, and among them are some very happily arranged; and there is something so simple in the fact of being able to point to any desired letter, that it is no wonder the public generally may, on a hasty glance, and before studying the practical merits of the case, be ready to decide in their favour, and prefer them to any other plan, the A, B, C of which is less obvious.[1]

In this epigraph extracted from the thirty-seventh issue of *Household Words*, Charles Dickens provides a glimpse into the user-friendliness of dial instruments and hints at their domestication. The year was 1850, ten years after the first prototype of a dial instrument was invented by Charles Wheatstone.[2] It would be another ten years before its design was finalised and the ABC instrument, as this dial apparatus came to be known, enabled the development of private telegraphy.[3]

Private telegraphy employed private wires dedicated to renters of ABC instruments, in contrast to public telegraphy which was based on a shared network infrastructure over which skilled operators in public telegraph offices transmitted telegrams using needle instruments. The secondary literature reviewed in the second section of this chapter only made occasional references to the existence of private wires and ABC instruments, at best amalgamating public and private telegraphy and often

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[1] Charles Dickens, 'Wings of Wire', *Household Words* 37 (7 December 1850): 243. In this first paper about the electric telegraph (two more were to follow in 1859 and 1869), Dickens expressed his wonder at this technology. Here, he compares needle and dial instruments, and clearly sees the advantages of the latter for the public at large, although it was yet to be commercialised.

[2] Sir Charles Wheatstone is a key figure in this thesis, and a short biography is provided in Appendix 1. It emphasises his early life as a musical instrument maker, an acquired skill which would have an influence on his vision of a domesticated telegraph instrument.

[3] For a history of the design of the ABC instrument, see Appendix 4 (From needles to dials).

conflating the concept of telegraph with telegram. It is this absence of scholarship on private telegraphy which has motivated this thesis.

As shown in Figure 1.1. below, the take-up of ABC instruments increased considerably from the 1860s to the 1880s. This steady growth in the installed base of ABC instruments reveals the remarkable success of private telegraphy.[4] Why then did historians of the Victorian telegraph overlook this branch of telegraphy? I believe that the nationalisation of the telegraph industry in 1870 and the events leading to it have monopolised the attention of scholars and overly influenced their works. Because the nationalisation was essentially about the availability and affordability of telegrams for the public at large, this has distorted the historiography of the Victorian telegraph. It resulted in portraying the Victorian telegraph as comprising only one strand of telegraphy: public telegraphy.

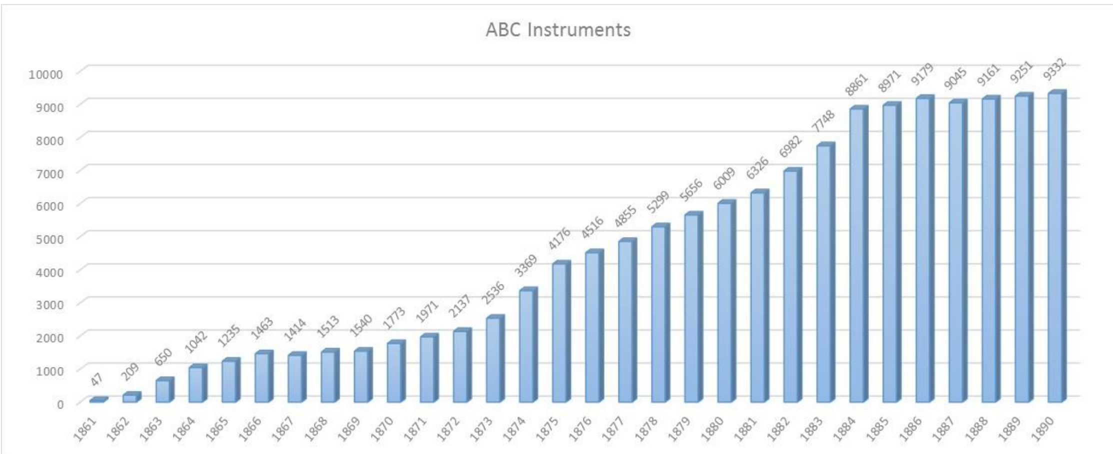

Figure 1.1. Total number of ABC instruments, pre- and post-nationalisation. Source: UPTC ledgers and Reports of the Postmaster-General on the Post Office (BT Archives, British Postal Museum & Archive).

[4] As can also be seen from Figure 1.1, nationalisation in 1870 had virtually no effect on the take-up of ABC instruments. I will show in this thesis that the Post Office reluctantly appropriated private telegraphy as part of the nationalisation before enthusiastically promoting it, which explains the take-up acceleration under its management until the mid-1880s.

My research investigates the development of private telegraphy between 1837, when Wheatstone first articulated his vision of a domestic instrument, to 1884, the last known date when a telegraphic intercommunication system, also known as an Umschalter, was employed by the Post Office as a telephone exchange.[5]

This is not to overlook public telegraphy, which is also included in the scope of my investigation to emphasise the distinctiveness of private telegraphy. The idea of sending a message instantaneously down a wire was undoubtedly revolutionary, and the telegraph caught indeed the imagination of the public of the time. However, I will be countering early and popular historians who, without distinction, declared telegrams ‘a revolution’ in the history of communication, arguing that telegrams were not fundamentally different in operation to letters, nor were they, for that matter, a faster means of communication by a significant margin for any but the most distant places.[6] Moreover, I will also challenge the received scholarly view from Jeffrey Kieve and Charles Perry that nationalisation was only a question of public dissatisfaction, ideology or growth of government, and argue that the rivalry between letters and telegrams also contributed to it.[7]

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[5] As will be explained later, Umschalters were initially employed as switching devices for ABC instruments, before the Post Office reconfigured them to provide exchange telephony as early as 1881.

[6] Historians who spoke of a revolution when referring to telegrams include Robert Albion, Tom Standage or Ronald Richie.

[7] Jeffrey L. Kieve, *The Electric Telegraph: A Social and Economic History* (Newton Abbot: David & Charles Ltd., 1973). Charles Perry, *The Victorian Post Office: The Growth of a Bureaucracy* (Woodbridge: Boydell Press, 1992).

Returning to the central theme of my thesis that has been captured in its title, we must ask: what was the origin, role and wider significance of private telegraphy in the British history of communication?[8] As I will reveal in this thesis, it was the need for more immediacy in communication that prompted private telegraphy. By 1884, there were 3,285 recorded private telegraphy contracts.[9] Compared to the hundreds of millions of letters delivered and the millions of telegrams transmitted on the public networks in that same year, this number may appear relatively small. However, the scope of private telegraphy extended well beyond private communication between renters of ABC instruments. Private wires were used on a broad range of services and had indeed a far wider societal impact. For example, they accelerated the distribution of vital economic and political news across the country and made possible the publication of daily editions by provincial newspapers. They enabled the broadcast of Greenwich Time to 'sympathetic' (electric) clocks in offices and factories, and, as a result, increased work productivity due to a more accurate and trusted timekeeping. They also facilitated the real-time transmission of alerts to police departments and fire brigades, thus decreasing the response time to emergencies and providing better utilisation of public resources.

This thesis is informed by the findings from three research questions which together form an inter-related whole. They are introduced below, and will be further discussed in the methodology section of this chapter following the literature review. The common thread between these questions is the concept of continuity. Firstly, I will argue that the link between telegrams and letters has been largely ignored. By establishing

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[8] Although focusing on the UK, this thesis also explores private telegraphy in the USA and France.

[9] 'Thirty Third Report of the Postmaster-General on the Post Office', 1887. 54.

that there was continuity between these two forms of written communication, my aim is not only to emphasise the discontinuity that occurred later with private telegraphy, but also to show that the efficiency of the reformed mail raised the expectation of faster interpersonal communication. This expectation was only partially met by telegrams sent via public telegraphy, leaving room for the development of private telegraphy. Secondly, I will dispute the received view that there was discontinuity between telegraphy and telephony. I will claim instead that there was continuity between (public) telegraphy and telephony, with private telegraphy providing the missing link.

As the review of secondary sources will reveal, the Victorian telegraph has been mostly studied in isolation of the mail system, thus ignoring the continuity between these two forms of communication. My first question addresses this deficiency:

- **To what extent did the advent of telegrams constitute the revolution in communication often portrayed by early and popular historians?**[10] Telegrams were introduced a few years after the Post Office implemented Rowland Hill's postal reform which transformed letters into a fast and efficient mass communication system. The revolution metaphor employed explicitly by some historians, and accepted implicitly by the others, will be challenged by means of a comparative study between telegrams and letters in terms of performance, affordability and convenience to the public.

[10] Here also, the term 'revolution' refers to the practicalities of communication: not how the communication worked, but how efficient the system was from a service perspective. This will be the case throughout this thesis.

In establishing continuity between telegrams and letters, I will also create a frame of reference for the second question below:

- **To what extent and in what ways was private telegraphy distinct from public telegraphy?** This question is at the heart of my thesis. It encapsulates a series of enquiries: What was the origin of private telegraphy? Was its underlying technology different from that of public telegraphy? Was it a new strand of telegraphy? What was private telegraphy able to do which public telegraphy could not? In what senses was it an important innovation in the history of communication?

The third and last question deals with the continuity between telegraphy and telephony:

- **In what respects can telephony be seen as continuous with and an extension of private telegraphy?** Returning to Figure 1.1., we can see that the take-up of private telegraphy tapered off in 1885 and beyond.[11] This was due to the increasing popularity of the telephone, whose function overlapped to some extent with that of the ABC instrument. Telephony started as a direct user-to-user communication, like private telegraphy, but soon evolved into exchange telephony.[12] Referring to public telegraphy, Kieve stated that the Post Office obstructed the expansion of telephony to

[11] However, the take-up of ABC instruments resumed throughout the rest of the century, albeit at a slower pace, reaching in excess of 12,000 ABC instruments by 1900.

[12] In exchange telephony, the switchboard operator routed manually the call to the requested subscriber.

protect the Crown's stake in telegraphy.[13] But what about private telegraphy? Was the development of telephony hindered or accelerated by private telegraphy? Kieve and Perry intuited but never provided evidence that there was a link between private telegraph wires and telephony. I will reveal that both the private wires and the ABC instruments were the missing link between telegraphy and telephony.

Having introduced the three pillars upon which my thesis is constructed, I now provide a short summary of the received narratives of the Victorian telegraph, before examining in more details the secondary literature.

1.1 The received narratives of the Victorian telegraph

In 1836, Baron Pawel Schilling developed a working five-needle electric telegraph.[14] It was this machine, presented at the University of Heidelberg by a colleague of Schilling, Professor Muncke, which William Fothergill Cooke saw in March 1836.[15] Cooke was so enthused by the potentials of this technology that he abandoned

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[13] Kieve, *The Electric Telegraph*, 214.

[14] Geoffrey Hubbard, *Cooke and Wheatstone and the Invention of the Electric Telegraph* (London: Routledge & Kegan Paul, 1965), 13.

[15] William Fothergill Cooke, *The Electric Telegraph: Was It Invented by Professor Wheatstone?*, vol. Part 1-Pamphlets of 1854-6. (London: W. H. Smith & Son, 1857), 14. For more information on Sir William Fothergill Cooke (1806-1879), English inventor and businessman, http://www.theiet.org/resources/library/archives/biographies/cooke.cfm, last accessed 27 January 2016.

his previous pursuit to devote his time to the task of building an electric telegraph.[16] Cooke's original telegraph, built in Germany in 1836, was a three-needle instrument employing six wires.[17] It included a remotely triggered alarm to attract the attention of the distant operator. His second prototype, also built in 1836, was an electro-mechanical telegraph built around the concept of a musical box mechanism. In that same year, Cooke brought this second prototype to London where he began to 're-imagine the commercial possibilities of an electrical telegraph', which led eventually to the formation of the Electric Telegraph Company (ETC) in 1846.[18]

Early adopters of the telegraph, apart from the railway companies, were government agencies, newspapers and businesses.[19] ETC enjoyed a monopoly until the early 1850s, at which point other telegraph companies began to enter the market. The Magnetic Telegraph Company (MTC) began operating in 1852. It was followed by the London District Telegraph Company (LDTC), which was formed in 1859, and then by the United Kingdom Telegraph Company (UKTC) which raised enough capital to start operation in 1860.[20] Finally, the Universal Private Telegraph Company (UPTC) was

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[16] According to Hubbard, Cooke was in Heidelberg from 1834 studying anatomy, having resigned his commission on grounds of ill-health in 1833 after having spent a year in India. Hubbard, *Cooke and Wheatstone and the Invention of the Electric Telegraph*, 27.

[17] Cooke called the device the "reciprocal communicator". Cooke, *The Electric Telegraph: Was It Invented by Professor Wheatstone?*, Part 1-Pamphlets of 1854-6.:27.

[18] Ben Marsden and Crosbie Smith, *Engineering Empires - A Cultural History of Technology in Nineteenth-Century Britain* (Basingstoke: Palgrave Macmillan, 2007), 189. In their comprehensive early history of the electric telegraph, Marsden and Smith examine the role and reputation of telegraph advocates. As we shall see in Chapter 3, the protection of Cooke's reputation was at the centre of his dispute with Wheatstone.

[19] The first practical use of the electric telegraph was a signalling application for the railways. Kieve, *The Electric Telegraph*, 19. Roger Neil Barton, 'New Media: The Birth of Telegraphic News in Britain 1847-68', *Media History* 16, no. 4 (2010): 382.

[20] UKTC was actually established in 1850, but was not able to raise sufficient capital at the time. Kieve, *The Electric Telegraph*, 59.

incorporated in 1861. These five operators, together with many other smaller and more specialised telegraph companies represented the Victorian landscape for telegraphy in the first half of the 1860s. ETC by far dominated the market, with MTC a distant second. Other companies offered little, if any, competition, except for UKTC which, for a short period, disrupted the market by adopting the pricing model of the penny post, that is, a uniform rate irrespective of distance. It was the lack of competitive forces amongst these companies that eventually brought the government into action. In this oligarchic environment the companies were able to impose high prices for their services, focusing their deployment strategy on large and more profitable urban centres. In the majority of cases, the telegraph office was located at the railway station, at an inconvenient distance from the centre of the towns. Smaller towns, those with up to 6,000 inhabitants, were without telegraph facilities. Complaints from the public about excessive charges and the lack of telegraph offices, and the calls for action from dissatisfied newspaper proprietors became a political issue that the Disraeli government could not ignore. The rush to pass the Telegraph Act, 1868, left the Gladstone government with unresolved matters, eventually settled with the Telegraph Act, 1869. Frank Ives Scudamore was the Post Office official behind the nationalisation bills.[21] His

[21] Frank Ives Scudamore (1823-1884), the architect of the nationalisation of the telegraphs and a controversial figure, spent his entire career as a Post Office civil servant, rising to the position of Receiver & Accountant-General in 1856. He made his mark in 1861 during the establishment of the Savings Bank which put him eventually in charge of a network of over 3,600 offices that all together generated gross revenues in excess of £1 million. As an advocate of government intervention, the enquiry entrusted to him by the Postmaster-General in 1865 was bound to be biased from the start towards state ownership and the nationalisation of the telegraphs. Appointed Second Secretary in 1868, Scudamore took charge of the new telegraph public service. His conception of his own role within the Administration led him to an autocratic style of management and complete disregard of the ministerial authority under which he was supposed to operate. Despite the scandal of 1873 about his over-spending, which led to the

zealous commitment to a public service and the vast resources he was able to draw from the government ensured the success of the transfer of the telegraphs to the Post Office in 1870. However, the excessive price paid for the telegraph companies, the generous treatment given to newspapers and railway companies, the reduction of the tariff, the increase in staff pay, as well as the increasing competition from the telephone companies, made it all but impossible to even meet the interest on capital, let alone to achieve a return on investment. Despite the burden on the taxpayers who had to finance this deficit, the operation was deemed a great success by the Postmaster-General in his forty-first report: by 1895, the number of telegrams sent annually had grown to more than seventy-one million, a tenfold increase since 1870, and the number of telegraph offices had increased in the same period from 3,000 to nearly 10,000. In effect, the public monopoly on the telegraphs had delivered an affordable and accessible service.

1.2 The historiographies of the Victorian telegraph

It may not be a coincidence that the attention given to the history of the Victorian telegraph by Jeffrey Kieve (1970, 1973) and other historians of the time was concomitant with the political debate associated with the transformation of the General Post Office into a public company in 1969. The subsequent split of the Post Office into two entities in 1980 led to the establishment of British Telecom. The monopoly which the Post Office had over the telegraph service was also brought to an end, marking an important

resignation of Postmaster-General William Monsell, Scudamore kept his job with Gladstone's support until his resignation in 1875. Perry, *The Victorian Post Office*, 121. Charles Perry, 'Frank Ives Scudamore and the Post Office Telegraphs', *Albion: A Quarterly Journal Concerned with British Studies* 12, no. 4 (1980): 364.

evolution towards the privatisation of telecommunication services. There was a gap of about twenty years before a new perspective on the development of the telegraph and the telephone, as part of a study of the Victorian Post Office, was provided by Charles Perry (1992). As the take-up of the Internet accelerated in the 1990s, Tom Standage (1998) wrote a popular history on the so-called Victorian Internet, renewing interest in the telegraph as the root of what he called 'the new communication revolution'.[22] Recent years have seen a revival of interest in the topic: Roger Neil Barton (2007) further explored the Victorian telegraph to fill a gap of knowledge left by Kieve, and Simone Fari (2015) even more recently revisited 'Victorian Telegraphy before Nationalization'.

Together with the other books and papers that relate to the subject, this body of work informs the historiography of the Victorian telegraph. A common denominator amongst these studies is a focus on the private telegraph companies that were nationalised in 1870 and the events leading to this nationalisation, using various mixes of social, political, economic and business histories. Far fewer of such studies include the post-nationalisation period, when the telegraphs were managed by the Post Office.

Having provided a broad context, I now examine the main histories of the Victorian telegraph, starting with Jeffrey Kieve's seminal work on the topic – a monograph based on his MPhil ('The Telegraph Industry 1837-1890') passed in 1970 at the London School of Economics and Political Science, and which has served as the main source for the

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[22] In this popular history of the Victorian telegraph, Standage tells how the telegraph 'unleashed the greatest revolution in communications since the development of the printing press'. (http://tomstandage.wordpress.com/books/the-victorian-internet/, last accessed 4 August 2013). Tom Standage, *The Victorian Internet: The Remarkable Story of the Telegraph and the Nineteenth Century's Online Pioneers* (London: Weidenfield & Nicolson, 1998).

received narrative in the previous section.[23] This is the most comprehensive history of the Victorian telegraph, and his work remains to date the main and most influential reference on this topic. It is a broad social and economic history of the Victorian telegraph, from its inception in the early years of the nineteenth century to its appropriation and management by the Post Office in 1870 and beyond, up to the nationalisation of the telephone in 1911. This chronological narrative can be broken down into four distinct phases: the early telegraphic experiments, the development of the telegraph under the companies, the case for a public service leading to the nationalisation, and finally the development of the telegraph under the Post Office. This last phase led to the large scale public service which, according to Kieve, hindered the development of the telephone.[24] The focus is clearly on telegrams and their uses, first by businesses, and then by the public at large. An entire chapter is devoted to the press subsidy, the syndication of news and the dependency of provincial newspapers on parliamentary and general news communicated via telegraph, demonstrating the importance of this sector in the history of the Victorian telegraph, an important aspect of the telegraph that has been further examined by Roger Neil Barton as we shall see below. Other applications are pointed out, such as the use of the telegraph in the railway industry, especially for the improvement in safety made possible by a better control of train traffic in single track operation via the block system. Kieve's comprehensive work is an unequal mix of social and economic histories, the latter being dominant throughout his work. Although pointing out various forms of instruments,

[23] Kieve, *The Electric Telegraph*.

[24] 'Thus from the beginning the telephone was regarded as a competitor to the telegraph and so was hampered in its growth'. Ibid., 214.

Kieve sees technology as almost irrelevant and he wraps his economic narrative around the 'black box' that is telegraphy.

Nearly four decades later Roger Neil Barton produced an account of the development of telegraphy during the early Victorian period. His is a business history of the private companies, and ETC in particular, prior to nationalisation.[25] Barton's PhD thesis fills a gap in knowledge left by Kieve between the late 1840s to the early 1860s. He draws attention to the relationship between John Lewis Ricardo and Robert Stephenson, the two men with the most influence on the direction taken by ETC. Barton postulates, for instance, that during the Railway Mania in the 1840s a secret group of railway engineers and businessmen led by Stephenson invested in ETC, speculating that railway companies would make increasing use of telegraph-based traffic management solutions.[26] The collapse of the speculative bubble, however, refocused ETC's attention towards the newspapers and the general public. The lowering of the price of telegrams to the level of a third class train ticket plus fifty per cent resulted in an increase in the volume of messages. Barton points out that ETC initially derived revenue from the maintenance of the wires installed on the railway tracks. With the transition from a railway-focused to a media- and consumer-focused business model, however, the company exchanged this income for an exclusivity deal – a strategic decision which had an impact on ETC's future, and the direction of the industry as a whole.[27] Barton also

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[25] Roger Neil Barton, 'Construction of the Network Society: Evolution of the Electric Telegraph 1837-1869' (PhD thesis, University College London, 2007).

[26] Ibid., 68–76.

[27] Ibid., 159.

examines the telegraph in a regional context, as well as in key sectors of the economy such as the financial services and the newspapers.

Barton's most recent paper continues this research into telegraphic news.[28] To a large extent it is based on his thesis, but it changes somewhat the perception of events provided in the original narrative. Specifically, Barton identifies divisions within ETC's executive board, leading to conflicts that ended with the resignation of John Lewis Ricardo, as executive chairman, in 1858. The thesis had previously identified a secret group of board members with a 'railway agenda'. In this paper, Barton argues that Ricardo's ambition was to create a distribution network for news and financial information. Provincial newspapers, Barton suggests, became quickly dependent on telegraphic news.[29] Realising the business potential, ETC created an intelligence department in order to produce these feeds more efficiently. MTC and UKTC soon followed ETC's lead and created their own intelligence departments. Eventually, these departments were merged into a joint operation, as part of an intelligence cartel between the telegraph companies – which allowed them to raise the prices charged for these feeds (Kieve prefers to refer to it as an agreement between ETC, MTC and UKTC to form a combined news and intelligence department).[30] Barton also portrays the liberal Ricardo as a victim of a lobby from 'hard-line protectionist Tories', presumably the secret group with the railway agenda now intent (following the collapse of the railways speculating bubble) on creating a monopoly for news distribution.[31] Having

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[28] Barton, 'New Media'.

[29] Ibid., 386.

[30] Ibid., 391.

[31] Ibid., 400.

been pushed to resign, Ricardo then secretly campaigned for the nationalisation of the telegraph companies.

The paper also provides an insight into the history of the media industry and the development of newsrooms. The clipping and republishing of news snippets existed before the telegraph, but telegraphic news accelerated the distribution of news to provincial newspapers. To kick-off this activity, ETC invested in a newsroom network. It needed to do so because the newspapers were still subject to the ‘tax on knowledge’, the newspaper stamp duty that was eventually abolished in 1855. Until that time, newspapers were expensive and infrequently published (usually bi-weekly). To feed information into its newsrooms, ETC created the intelligence department whose role was to produce the information sold to subscribers such as the newsrooms, the newspapers and the stock exchanges. With the stamp duty abolished, provincial newspapers began publishing dailies, which increased the demand for telegraphic feeds. By this time, other telegraph companies had been incorporated and they followed suit, creating their own intelligence departments. Journalists were given preferential tariffs; Reuter and *The Times* had a special arrangement with ETC. Later, the creation of the joint intelligence department (the cartel mentioned above) resulted in concessionary rates being revised steeply upwards. Barton speaks of monopoly prices. Overall, Barton’s thesis and his subsequent paper reinforce Kieve’s research, providing at the same time some corrections and additional details into ETC’s business history.

I now turn my attention to the American historian Charles Perry and his studies of the Victorian Post Office and the Victorian telegraph. These political histories are generally centred on the nationalisation question.[32] Historians, he argues, have put too much emphasis on the link between nationalisation and the political ideology of the day. For Perry, nationalisation was more a reflection of the Victorians' willingness to test the efficiency (and growth) of government. Perry describes how Scudamore's previous association with William Gladstone during the successful development of the Post Office Savings Bank, and his alliance with the reformer Edwin Chadwick, helped increase his credibility and mobilise public opinion.[33] He also suggests that Scudamore's zealous involvement in the telegraph in 1865 could have been driven by a desire to escape the 'dismal results of the life insurance program' that he had set-up the year before at the Post Office. But despite this political support, Scudamore's association with the telegraph led to conflicts with the Treasury, and eventually to his downfall. This situation, however, as Henry Parris wrote in his review of Charles Perry's book, 'helped to define the doctrine of ministerial responsibility'.[34] Perry also argues that Kieve's view that the Post Office hampered the development of the telephone to protect the telegraph is seriously misleading, preferring instead to believe that the Post Office was caught in the middle of a political intrigue between the Treasury and the nascent telephone industry. As evidence, he points out the department's purchase of all the companies' trunk lines in 1892 as an apparently genuine commitment to facilitate inter-urban communications between subscribers of different telephone companies. For

[32] Perry, *The Victorian Post Office*. Perry, 'Frank Ives Scudamore'. Charles Perry, 'The Rise and Fall of Government Telegraphy in Britain', *Business and Economic History* 26, no. 2 (1997).

[33] Perry, 'Frank Ives Scudamore', 354.

[34] Henry Parris, 'Review of The Victorian Post Office by Charles Perry', *Victorian Studies* 37, no. 3 (Spring 1994): 483.

Perry, the nationalisation might have remained stalled but for the companies' crucial miscalculation of abandoning the uniform tariff of a shilling for 20 words agreed amongst themselves following UKTC's attempt at emulating the penny post.[35] As we will see later in this thesis, however, this is doubtful as Scudamore's inquiry was initiated at the same time, and it is more likely that the companies were simply increasing their tariffs to improve margins in view of their expected appropriation.[36]

Like Perry, the former *Financial Times* and *Economist* journalist Duncan Campbell-Smith recounts the development of the telegraph during the Victorian era, as part of a commissioned history of the Royal Mail which spanned the sixteenth to the twentieth centuries.[37] As he points out himself, Campbell-Smith's account of the telegraph is largely based on Perry's work. It is interesting to note that by placing his account of the telegraph in a wider context, Campbell-Smith is able to draw parallels between Rowland Hill's penny post and Scudamore's telegraph, starting with the similarity of their personal characters: both Hill and Scudamore were mavericks and reformers with a contempt for political etiquette. They also fell out of favour at the end of their careers despite the relative success of their endeavours. The similarity of the penny post and the telegraph strategies is remarkable. Both adopted a mass market approach with pricing irrespective of distance. Financially, the two ventures also turned out to be unprofitable. Both saw a huge rise in volume of communication following their

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[35] Perry, *The Victorian Post Office*, 92.

[36] The Railway Act of 1844 had set out a precedent for the valuation of private companies based on net profits.

[37] Duncan Campbell-Smith, *Masters of the Post - The Authorized History of the Royal Mail* (London: Penguin Books, 2011).

introduction, but failed to deliver the expected economies of scale. As Kieve had pointed out earlier, Scudamore had used the analogy of the penny post to support the uniform rate and he was vindicated by the resulting increase in telegraph traffic following its introduction. Akin to the penny post undertaking, however, this increase was accompanied by an even greater increase in expense, thereby negating the benefit of increased traffic that was supposed to compensate for the lower tariff.[38] Campbell-Smith's reliance on secondary sources for the telegraph history, however, leads to misinterpretation, such as his reference to a 'cartel of five companies', when writing about the three companies that engaged in the joint intelligence department.[39]

More recently, economic historian Simone Fari wrote a history of the nationalisation of the Victorian telegraph.[40] The narrative follows the development of ETC, then the duopoly with MTC, and finally the oligopoly situation when UKTC entered the market, before analysing the events that led to the nationalisation. While Kieve was the first to write about the combined news and intelligence departments between ETC, MTC and UKTC in 1865, Fari, like Barton, believes that a price cartel first existed in 1855 between ETC and MTC, ten years before the intelligence cartel was established.[41] Fari acknowledges Perry's view that the progressive expansion of the government in the late nineteenth century was a factor in the nationalisation. Less credibly, though, he

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[38] Kieve, *The Electric Telegraph*, 184.

[39] Campbell-Smith, *Masters of the Post*, 176.

[40] Simone Fari, *Victorian Telegraphy before Nationalization* (Basingstoke: Palgrave Macmillan, 2015).

[41] Kieve, *The Electric Telegraph*, 71, 72. Barton, 'New Media', 389. Fari, *Victorian Telegraphy before Nationalization*, 106, 152. Barton, 'Construction of the Network Society', 187.

argues that the motivation behind it derived from international politics, and the constitution, in 1865, of the International Telegraph Union.[42] However, his citation of an ETC statement in 1868 ('What is a telegram? Practically it is an open letter') and his concluding remark 'The presence of an efficient and economical postal service certainly hampered the possibilities of the telegraph service right from the start' will resonate well later in this thesis.[43]

Other historians have produced less influential histories of the Victorian telegraph. I am now citing some of these miscellaneous works, beginning with Geoffrey Hubbard's popular early history of the telegraph which is also referenced in the previous section. His narrative makes extensive use of anecdotal stories such as the story of John Tawell, a suspected murderer who was seen boarding a GWR train in Slough in January 1845 and much to the surprise of this 'respectable-looking man in the garb of a Quaker', intelligence had travelled faster than the train carrying him and he was later arrested as a result of a telegraphic message giving advance notice to the police in Paddington Station. Much attention is given to early experiments and to the dispute between Cooke and Wheatstone in the early 1840s. Hubbard states that the dispute was triggered by Wheatstone usurping Cooke's mechanical telegraph as his own.[44] I show later in this thesis that this is an inaccurate statement as Wheatstone demonstrated his own instrument, the one specified in the joint patent of 1840, not the improved Cooke's mechanical telegraph, also specified in the same patent (a

[42] Fari, *Victorian Telegraphy before Nationalization*, 198.

[43] Ibid., 176, 206.

[44] Hubbard, *Cooke and Wheatstone and the Invention of the Electric Telegraph*, 89.

description of this and other patents can be found in Appendix 4). Nonetheless, an interesting cross-fertilization concept is presented during the development of the early telegraph instruments.

Edward A. Marland, a former engineer at Marconi's Wireless Telegraph Company, wrote an account of early electrical communication, from the galvanic telegraphs to the telephone.[45] In 1964, this work must have represented a major contribution to the topic. His view of the dispute between Cooke and Wheatstone, however, is particularly biased towards Cooke, accusing Wheatstone of 'falling little short of intellectual dishonesty', 'appropriating the credit for work strictly due to other men', 'seeming bent on taking upon himself the entire credit for the telegraph' or 'misappropriating a number of Bain's inventions'. As I demonstrate in this thesis, this episode between the two men is rather more complicated, and no evidence supports Marland's opinionated view on the topic.

Keith Dawson's PhD thesis is an in-depth history of the electric telegraph technology.[46] His work is a broad investigation of the technology from 1830 to 1860, from a British, European and American perspective. Dawson demonstrates the direct influence of scientific and industrial activities in the countries concerned. In Europe, for instance, it was the tradition of precision instrument-making which influenced telegraph technology. Many telegraph builders were, by vocation, clockmakers, their skills and knowledge not only fulfilling the requirements for building the instruments, but also

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[45] Edward A. Marland, *Early Electrical Communication* (London: Abelard-Schuman, 1964).

[46] Keith Dawson, 'The Early History of Electro-Magnetic Telegraph Instruments' (unpublished PhD thesis, Dept. of History of Science & Technology, Imperial College of Science and Technology, 1973).

encouraging diversity in the design of the early signalling devices. In contrast, American telegraph builders made better use of their advances in the use of mechanics for metal forming in metal working shops.

Like Marland, Ken Beauchamp was an electrical engineer, and his history of telegraphy has been mostly written from secondary sources.[47] His account of the dispute between Cooke and Wheatstone benefited from the biography of Wheatstone by Brian Bowers, first published in 1975.[48] Beauchamp showed some interest in the ABC instrument, believing that that UPTC promoted and offered this instrument 'in keeping with its policy of employing a minimum of staff.'[49]

More recently, John Bray produced another history of communications, from the electric telegraph to broadband internet.[50] It is worth noting the reference to frequency division multiplexing using mechanical resonance (harmonic telegraph), as suggested by Elisha Gray, François van Rysselberghe, Thomas Edison and others in the 1870s and 1880s. According to Bray, the first use of duplex telegraphy took place in Vienna where Dr Gintl used a balanced-bridge arrangement to send and receive messages simultaneously.

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[47] Ken Beauchamp, *History of Telegraphy* (London: The Institution of Electrical Engineers, 2001).

[48] Brian Bowers, *Sir Charles Wheatstone FRS 1802-1875*, Second edition (London: The Institution of Electrical Engineers, 2001). The first edition was published in 1975.

[49] Beauchamp, *History of Telegraphy*, 79.

[50] John Bray, *Innovation and the Communications Revolution: From the Victorian Pioneers to Broadband Internet* (London: The Institution of Electrical Engineers, 2002).

More relevant to this thesis is the work of Iwan Rhys Morus, which illustrates the way the telegraph broke down the barriers of space and time in the Victorian Age.[51] Although acknowledging the railways as the leading and perhaps most visible application of the telegraph, Morus cites many other applications of the telegraph, including the synchronization of time which is the subject of a deeper study later in this thesis.[52]

1.3 Historiographical distortion and duality paradigm

The discourse that emerged from these accounts is shaped by the importance given to the watershed in British history that was the nationalisation of the telegraphs.

This focus on nationalisation, and therefore on public telegraphy, has somewhat distorted the historiography of the Victorian telegraph. Kieve, for instance, dedicated only two pages, or less than one per cent of his work, to UPTC and the private telegraphs.[53] This resulted in the conflation of the concept of telegraph with telegram, and the depiction of the Victorian telegraph as having only one strand of telegraphy.[54]

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[51] Iwan Rhys Morus, '"The Nervous System of Britain": Space, Time and the Electric Telegraph in the Victorian Age', *The British Journal for the History of Science* 33, no. 4 (1 December 2000): 455–75.

[52] Scientific instrumentation applications included the Wheatstone mercury thermometer-telegraph mounted on an atmospheric balloon (tested in Woolwich). See also François Moigno, *Traité de Télégraphie Electrique, renfermant son Histoire, sa Théorie et la Description des Appareils* (Paris: A. Franck, 1852), xiv.

[53] Kieve also mentioned the City of London Police telegraphs, but made no reference to private telegraphy in those cases. Kieve, *The Electric Telegraph*, 68–70, 217, 245.

[54] Here, I differentiate the act of receiving a telegram via a private messenger, which was similar to receiving a letter via a letter-carrier employed by the Post Office, from the act of receiving a message on a private ABC instrument (without human mediation).

Undeniably, the national debate about the nationalisation of the telegraphs was about the appropriation of the private companies which, like ETC or MTC, were perceived as 'public institutions of necessity'; in other words, those companies that provided a telegram service to the public at large.[55] I use the term 'public telegraphy' throughout this thesis to refer to such a service. The term 'telegram(s)' is also employed interchangeably with 'public telegraphy', especially pre-nationalisation to avoid the oxymoron 'privately-owned public telegraphy'. Public telegraphy required a shared network infrastructure referred to as the 'electric highway' by the *Observer*, as well as human mediation: the operators who transcoded and transcribed the messages at both ends of these electric highways, and the messengers who delivered the telegrams.[56]

In this thesis, I claim that there were not one but two strands of telegraphy in the UK. I contend that the emphasis given to public telegraphy in past accounts has obscured the second strand, 'private telegraphy', a term employed as early as 1863 to describe the branch of telegraphy that provided individuals and organisations with 'better, quicker, private' telegraph lines.[57]

In contrast to public telegraphy, private telegraphy was an unmediated, user-to-user communication facility delivered over dedicated telegraphic lines, the private wires, with the provision of telegraphic instruments on renters' premises.[58] Whereas

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[55] The term 'public institution of necessity' was described in Anon, 'Private Telegraphy', *The Telegraphic Journal: A Weekly Record of Electrical Progress* 1, no. 1 (2 January 1864): 2.

[56] The expression 'electric highway' described the wires stretched across poles along the railways and the public roads. 'The Electric Highway', *Observer*, 7 January 1861, 5.

[57] Anon, 'Private Telegraphy', 2.

[58] Telegraphy was a mediated form of interpersonal communication, with electricity (over physical wires) acting as carrier of information. Beyond this technological mediation, however,

public telegraphy employed relatively simple needle instruments that required skilled operators to transcode and transcribe the messages, private telegraphy relied on the more user-friendly, albeit more complex ABC instruments that could be operated by any literate person. Private wires, unlike the electric highways, allowed a renter to converse, in writing and in quasi-real-time, with another renter or a telegraph office operator located several miles away. Moreover, although initially designed as a user-to-user communication facility, with private wires and ABC instruments providing the underlying technology, private telegraphy eventually branched out into a variety of applications that exploited the immediacy afforded by the private wires, using different telegraphic instruments.

My aim is to redress the historiographical distortion by bringing to light this second strand of telegraphy, private telegraphy, which not only co-existed alongside public telegraphy but had also a wider societal impact than its public counterpart.[59] This dichotomy between public and private telegraphy, which I refer to as the duality paradigm, is the overarching theme of my thesis.

My research differs from previous histories of the Victorian telegraph by the prominence given to private telegraphy and by its scope. It extends nearly five decades, from the early days of the commercialisation of the electric telegraph (a period which

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human mediation played an important role – most notably in public telegraphy where skilled operators and messengers were necessary to establish end-to-end communication. This was not a requirement in private telegraphy, as the ABC instruments could be operated directly by the originators and recipients of the messages, hence the use of the term 'unmediated' to describe its operation.

[59] I demonstrate in this thesis that telegrams (relative to letters) were not as fast as popularly believed. It is indeed a stretch of the imagination to believe that they were what Standage called the 'greatest revolution in communications since the development of the printing press'. Standage, *The Victorian Internet*, 66.

coincides with the implementation of Rowland Hill's postal reform) to the beginnings of exchange telephony.

1.4 Methodology

I explain now the method employed to redress the historiographical distortion discussed in the previous section.

The method is, in effect, a two-stage deconstruction of the Victorian telegraph: firstly, I look at telegrams and provide evidence of their functional overlap with letters; secondly, I expose the dichotomy between public and private telegraphy by demonstrating the disruptive nature and distinctiveness of the latter, therefore establishing the duality paradigm and claiming that there was not one but two different strands of land telegraphy. To this end, my discourse is articulated around the three interconnected questions mentioned earlier in this chapter.

The first question (to what extent did the advent of telegrams constitute the revolution in communication often portrayed by early and popular historians?) probes the level of societal disruption caused by telegrams in comparison to letters. Did public telegraphy convey continuity or change in the history of communication? As shown in the literary review, with the exception of Campbell-Smith, historians have traditionally looked at telegrams in isolation from other forms of correspondence, and this has led to the assumption that public telegraphy was a radical innovation. By extending the scope of my research to postal services, I will be able to consider the veracity of this assumption. Moreover, the answer to this question will also serve to establish a frame of reference for the second question.

This second question (to what extent and in what ways was private telegraphy distinct from public telegraphy?) deals with the duality paradigm. It will involve research into the origin and the evolution of private telegraphy to determine if it represented a different strand of telegraphy. It is interesting to note that the ABC instrument features in most historical accounts, but it is usually indiscriminately associated with other instruments of the day, and often credited to both Wheatstone and Cooke – even though its design was radically different, its inventor was Wheatstone alone, and its purpose was largely unconnected with telegrams.[60] While Kieve and Perry, amongst other historians, made references to private wires and ABC instruments, none have identified private telegraphy as a different strand of telegraphy and explained its significance.[61]

The relationship between private telegraphy and telephony, or exchange telephony to be exact, is addressed in the third and last research question (in what respects can telephony be seen as continuous with and an extension of private telegraphy?). Both Kieve and Perry argued that the financial burden of the nationalisation of the telegraphs interfered with the development of telephony. Indeed, if the Victorian telegraph is reduced to telegrams such a position is justifiable.[62]

[60] There is one case where the ABC instruments have been used in connection with public telegraphy as I will point out later in the thesis (see reference to Eriskay Island).

[61] Kieve made the most occasional references to private wires and ABC instruments in relation to Wheatstone and UPTC. He even wrote about the popularity of 'private telegraphs for public institutions, offices, warehouses and factories', as well as mentioning the 'special wires' that I explore later in the thesis. However, at no time did Kieve (or Perry, Barton and Fari, for that matter) recognise private telegraphy as a different strand of telegraphy, or its significant societal impact. Kieve, *The Electric Telegraph*, 68, 217.

[62] Perry believed that the Post Office had no choice in the matter, as it was caught in the middle of a political intrigue between the Treasury and the nascent telephone industry. Perry, *The Victorian Post Office*, 146.

However, it is interesting to note that they also intuited (but never provided evidence) that there was a possible link between the private wires and telephony. I will explore this link to argue that, first, long before the telephone, private telegraphy had shown that interpersonal communication over electric wires was not only feasible, but also desirable; second, that the large number of installed private wires had a positive effect on the development of telephony; and third, that private telegraphy spurred the development of exchange telephony by enabling the transformation of the Post Office into a telephone operator.

To further the understanding of private telegraphy, my discourse references two theoretical frameworks: the Social Construction of Technology (SCOT) and the domestication of technology theory. SCOT is essentially based on the notion that a technology is constructed as a result of social interactions with relevant social groups.[63] Different social groups can have different understandings of a given technology, and this 'interpretative flexibility' is a key concept in the SCOT framework.[64] Trevor Pinch and

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[63] The social groups are organisations or individuals, including the makers and users of the technology, as well as its detractors, promoters, legislators and any other social group related to the technology. Trevor Pinch and Wiebe Bijker, 'The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other', *Social Studies of Science* 14 (1984): 399–431. Wiebe Bijker, Thomas P. Hughes, and Trevor Pinch, eds., *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (MIT Press, 1989).

[64] This social shaping process has been given another name by Cowan. She referred to it as the 'consumption junction' to reflect 'the place and the time at which the consumer makes choices about technologies'. Ruth Schwartz Cowan, 'The Consumption Junction: A Proposal for Research Strategies in the Sociology of Technology', in *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (The MIT Press, 1993), 263. It is also interesting to note that Woolgar has explained this interpretation process in a different way when suggesting the metaphor of the 'machine as text': a method that examines a technology through the processes of construction (writing) and use (reading). Keith Grint and Steve Woolgar, *The Machine at Work: Technology, Work and Organization* (Polity Press, 1997), 70.

Wiebe Bijker first demonstrated this concept in a study of the Penny-farthing – a study which also highlighted the multi-directional character of the development of Victorian bicycles. Using a multi-directional model, they revealed that one technological path (amongst the ones that could have been taken during the development process) was successful.[65] Success, here, was explained by the acceptance of the technology by a relevant social group, and not just because it worked. From the SCOT framework, I will borrow the multi-directional and interpretative flexibility concepts to explain certain critical parts of the development of private telegraphy.

The domestication theory is also about the relationship between humans and technologies.[66] Here, however, the process goes further than the interpretation of technologies by relevant social groups; it emphasises the interaction between humans and technologies. The dynamics of consumption, where humans react to the functional and physical characteristics of technologies, is at the heart of this theory. The act of domestication requires that humans form relationships with technologies in everyday settings, a relationship in which reciprocal changes occur – in other words, users are not

[65] Why was it ever constructed, asked Pinch and Bijker? The design of the highly unstable and even dangerous Victorian high-wheeled bicycle made little sense. Yet it was, for a period of time, a commercial success. By tracing the meanings attributed to the bicycle by different social groups, they identified one group as the 'guilty' party for this success: the athletic upper- and upper-middle-class young men who wanted to impress their lady-friends in Hyde Park. For the authors of this paper, this group of 'young men of means and nerve' constructed the 'macho machine', thus demonstrating the interpretative flexibility of the technology. Pinch and Bijker, 'The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other', 411.

[66] Roger Silverstone and Eric Hirsch, eds., *Consuming Technologies - Media and Information in Domestic Spaces* (Routledge, 1992).

treated as passive recipients; they shape technologies to suit their practical needs.[67] Initially developed to describe and analyse the acceptance, rejection and use of media technologies by consumers, it has been later extended to business users. The domestication theory is particularly relevant to the ABC instrument in the context of this thesis.

1.5 Sources

Many primary sources referenced in this thesis have been previously known to historians, but perhaps examined and narrowly interpreted in the context of their research into the nationalisation and public telegraphy. In one case, for instance, I demonstrate that Kieve missed important details in his examination of the arbitration proceedings related to the dispute between Cooke and Wheatstone in the early 1840s, which led to an oversimplification of his interpretation of the events and their outcomes.

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[67] Ibid., 25. See also: Merete Lie and Knut H. Sorensen, eds., *Making Technology Our Own - Domesticating Technology into Everyday Life* (Scandinavian University Press, 1996). Jo Pierson, 'Domestication at Work in Small Businesses', in *Domestication of Media and Technology*, ed. Thomas Berker et al. (Open University Press, 2006), 205–26. The domestication model describes three phases which are not necessarily linear: the 'commodification' stage where the technology receives its initial function or meaning, the 'appropriation' phase where the technology is acquired by users and potentially adapted to their environments (or vice-versa), and the 'conversion' stage where the consumer contributes to the 'currencies of meanings' – that is when a feedback occurs and a new meaning is communicated back to the outside world. The appropriation and conversion stages are most pertinent to the domestication process. Gooday's approach to domestication complements the work of Silverstone and others in a historical context. It is based on a two-pronged process: a translation phase (if appropriate) and a mitigation phase. Like electric lighting, private telegraphy saw a translation (or transfer) from the public to the domestic domain. Most importantly, however, private telegraphy had to mitigate the challenges related to the aesthetic and usability of the ABC instrument. Graeme Gooday, *Domesticating Electricity: Expertise, Uncertainty, and Gender 1880-1914* (London: Pickering & Chatto, 2008), 26–28, 219.

In the course of this research, I have also come across new material, especially during the investigation into the origin of private telegraphy.

Primary sources consist on the one hand of material traditionally available in archives, and on the other hand of dematerialised information available online. The BT Archives in London have supplied the majority of material.[68] These archives hold extensive material about the private telegraph companies and the Post Office telegraphs. The UPTC records, in particular, were critical for my research; these included various agreements, ledgers, cash books, and other correspondence and company papers such as the arbitration proceedings. Frank Ives Scudamore's papers, the Postmaster-General Reports, Colin Brodie's papers and some of Charles Wheatstone's papers were also found in these archives, and so was an extensive photograph collection and a secondary source library.[69] The British Postal Museum & Archive in London (soon to be renamed and relocated) was also visited to access the records related to the inland mail organisation and services, the travelling post offices and business statistics, as well as the private papers of Rowland Hill and William Preece.[70] The Institution of Engineering and Technology (IET), formerly the Society of Telegraph Engineers back in

[68] Many collections preserved in the BT Archives have now been digitised as part of a major Jisc-funded collaborative project with the National Archives and Coventry University. Unfortunately, the electric telegraph collection was not in the scope of that project. This collection is now referenced under a new cataloguing system, although at this time it can still be searched using the 'old' Post Office cataloguing system.

[69] Colin Brodie was a telegraph engineer, employed first by UPTC, before moving to the private wires department of the Post Office Telegraphs in 1870 following the appropriation of UPTC.

[70] William Preece was a telegraph engineer employed by ETC before joining the Post Office in 1870 as Chief Engineer in the Telegraph Department.

1871, was also crucial for my research.[71] I searched these archives for the important collection of Cooke's and Wheatstone's papers and, in particular, the documents related to the early experiments, the arbitration proceedings and the set-up of ETC. Blythe House, the Science Museum's archive in London, was also useful for its extensive collection of artefacts, particularly its large number of needle and dial instruments. Finally, a copy of all the patents from Cooke and Wheatstone were obtained from the Intellectual Property Office in Swansea.

Online search was used extensively. A growing number of digitised archives and online databases are available, accelerating the identification and localisation of material. The Gale Primary Sources tool was especially useful for accessing the nineteenth-century British Library newspapers and the nineteenth-century UK periodicals. *The Times* and other newspapers provided a wealth of information, such as anecdotal evidence, the launch of telegraph companies or their current state of affairs. Similarly, Hansard transcripts revealed politicians' positions at the time – positions reflecting to some extent their constituencies' sentiments about telegraphy, especially during the parliamentary debates about the Telegraph Acts of 1868 and 1869. The Science in the Nineteenth Century Periodical Electronic Index (SciPer) was employed to browse the index of periodicals such as *Punch*. Other online databases included Connected Histories, JSTOR, Dickens Journals Online, the Bank of England Archive, or Gallica, the online Bibliothèque Nationale de France. Some contemporary documents were also obtained via the Internet Archive, for instance the proceedings of the Royal

[71] A brief history of the IET can be found at http://www.politics.co.uk/opinion-formers/institution-of-engineering-and-technology/a-brief-history-of-the-iet, last accessed 21 May 2016.

Society of London and the British Association for the Advancement of Science, and reports from various Select Committees that provided unique recordings of witness testimony, like the 'Report of the Select Committee on the Post Office Telegraph Department' (1876). Some large documents, such as the 'Report by Mr Scudamore on the Re-Organisation of the Telegraph System of the United Kingdom' (1871), were converted into searchable documents for finer analysis.[72]

1.6 Overview and structure of the thesis

The organisation of the thesis is as follows: The next two chapters, **Chapter 2 (Haste! Post Haste!)** and **Chapter 3 (The rise of public telegraphy)**, are essentially thematic and deal with the first question, which probes the level of societal disruption caused by telegrams in comparison with letters (did telegrams convey continuity or change in the history of communication?). **Chapter 4 (The origins of private telegraphy)** and **Chapter 5** (**The versatility of private telegraphy)** are, by and large, organised in a chronological order, and answer the second question (to what extent was private telegraphy distinct from public telegraphy?), while **Chapter 6 (The assimilation of private wires)** focuses on the third question (what was the causal connection between private telegraphy and telephony?).

In **Chapter 2 (Haste! Post Haste!)** I draw attention to postal services, and seek to place the Victorian telegraph discourse in a wider context by providing an aperçu of

[72] Qualitative data analysis was also attempted using QSR International NVIVO software but the quality of the OCR conversation for most documents was not sufficient to take advantage of this facility.

postal services prior to and during the age of telegraphy, but before nationalisation. The purpose of this chapter is to provide the context into which telegraphic communication was introduced. I show that the Royal Mail demonstrated a quasi-obsession for constantly improving the speed and efficiency of its mail operation. Remarkable progress was achieved during the first half of the nineteenth century with the development of urban or penny posts and with the reform that took place in the 1840s with the prepayment by stamp, the adoption of a distance-independent uniform postage rate, and the increase in the number of post offices across the country to transform the Post Office into an efficient and ubiquitous communication service provider. It is against this background that the electric telegraph was introduced.

Chapter 3 (The rise of public telegraphy) introduces the electric telegraph, and more importantly, public telegraphy. In view of the Royal Mail's proven and efficient operation, most private telegraph companies looked upon it as a reference model. The companies replicated the organisation of the Post Office to a large extent, with telegraph stations emulating the local post offices as collection points, the electric highways supplanting the mail-trains for the conveyance of the messages, and messenger boys, like the letter-carriers of the Post Office, delivering the telegrams. Having established in Chapter 2 (postal services) a benchmark for performance and affordability, I demonstrate in Chapter 3 that for all intents and purposes, telegrams were letters, and this will have repercussions during the national debate about the nationalisation of the telegraph industry. Having approached the topic from a broader perspective, I am able to show that telegrams were not the communication revolution often touted in popular literature or early histories.[73] Victorians perceived telegrams and letters as complementary, or even interchangeable – both forms of communication providing a similar epistolary service. Save for their laconic style, telegrams were essentially letters conveyed by a new technology. In other words, telegrams did not profoundly transform the way Victorians communicated with each other, and I claim that they were not as disruptive as implied by the revolution metaphor. The study of the electric telegraph in isolation of contemporary postal services has contributed to the belief that telegrams constituted a major discontinuity in the history of communication. In this chapter, I provide evidence that a rivalry existed between the two types of communication, which in turn, I argue, largely contributed to the nationalisation of the telegraph industry.

Chapter 4 (The origins of private telegraphy) begins in 1857. It offers a contrasted view of telegraphy: here, I demonstrate the distinctiveness of private telegraphy, which was a more direct and unmediated form of communication that created a sense of temporal and spatial immediacy as never before experienced with telegrams. After revealing how private telegraphy was born out of a want for a more immediate form of communication, I examine the challenges of its domestication.[74] Unlike its public counterpart, private telegraphy required renters of private wires to operate ABC instruments, and the 'taming' of such devices was a critical success factor. I reveal how Wheatstone's vision of a domesticated instrument – one that could be operated by any

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[73] For an example of a popular history of the telegraph, see Tom Standage, *The Victorian Internet*. For an earlier reference: Richard John, 'American Historians and the Concept of the Communications Revolution', in *Information Acumen - The Understanding and Use of Knowledge in Modern Business*, ed. Lisa Bud-Fredman (London: Routledge, 1994).

[74] See Chapter 4, footnote 277 for an explanation of my use of the term 'want'.

literate person with little or no prior formal training in telegraphic communication – made private telegraphy possible. This chapter also provides a comprehensive history of UPTC and of the take-up of private telegraphy across the country, while offering a limited international perspective on private telegraphy that suggests that Britain was amongst the first, if not the first country in the world to have implemented on a large scale the concept of private telegraphy.

In **Chapter 5 (The versatility of private telegraphy)**, which begins in 1868, I continue to differentiate private telegraphy from public telegraphy, and reinforce its importance in the history of the Victorian telegraph. In the first instance, I reveal that Scudamore was reluctant at first to take over the private wires in the context of nationalisation, as he was only initially interested in public telegraphy. Eventually though, UPTC was appropriated by the Post Office, and a separate department was created to manage the private wires – further evidence that private telegraphy was different to public telegraphy. In contrast to Chapter 4 where I examined the use of private wires for short distance communication between two ABC instruments, here I explore their use in long distance applications. Crucially, I show that private wires were employed when telegrams did not provide a sufficient level of immediacy or when the volume of messages transmitted would have had an impact on the traffic of public telegrams, or been impacted by it. For instance, many provincial newspapers employed special wires, the so-called press wires, used by day for public telegraphy and rented at night to the newspapers for their exclusive use – in effect becoming private wires. The regulation of time, especially the time service offered by the Post Office, is also examined to further demonstrate the diversity of applications that were enabled by the private wires. There were many other utilisations of private wires, from the stock wires which transformed the operation of the securities market to the provision of private telephony which brings this chapter to a close in the early 1880s.

Chapter 6 (The Assimilation of Private Wires) focuses on the causal connection between private telegraphy and telephony. More precisely, in this chapter I demonstrate how the Post Office contributed to the early development of exchange telephony because of its prior involvement with private telegraphy. In other words, I counter Kieve's view that the Post Office deliberately prevented the early development of telephony to protect its investment in telegraphy. In exploring the synergies between private telegraphy and telephony, I reveal the critical role played by the private wires and the telegraphic intercommunication systems, also known as Umschalters or universal switches. I begin with a broad perspective that covers the early days of telephony from 1877 to 1884, a short but critical period where the public discourse on telephony increasingly overlapped with that regarding telegraphy. The conduct of the Post Office in response to this disruptive innovation is discussed to explain its ambivalent policies towards the private telephone companies, and I also provide an insight into the first operational telegraphic intercommunication system in Newcastle, allowing renters of ABC instruments to communicate with each other or with the telegraph office. It was by replacing ABC instruments with telephones, connected over the same private wires leading to a reconfigured intercommunication system, that the Post Office established its first telephone exchange in the Swansea district on 23 March 1881. I reveal how the Umschalter technology enabled the Post Office to compete with the private telephone companies during the first few years of exchange telephony. It was during this period, lasting until the mid-1880s, that many telegraphic private wires were progressively assimilated by telephony, and became known as subscriber lines.[75]

Four **appendices** are also included. The first appendix is a short biography of Sir Charles Wheatstone, a figure who features prominently in this thesis. It emphasises, in particular, his early days as a music instrument maker as this would influence his subsequent involvement with private telegraphy. It also provides evidence of his integrity as a man of science, a trait of character denied to him by Marland as we saw earlier, and further discussed in Chapter 3. The second appendix is a partial list of UPTC customers, while the third lists the location of the Post Office telegraphic intercommunication systems with their dates of commencement. Finally, the fourth appendix is a history of the ABC instrument – the instrument at the heart of private telegraphy – narrated through an analysis of the related patents.

1.7 Conclusion

In this introduction, I have shown that there was an amalgamation made between telegraph and telegram in the narratives of historians of the Victorian telegraph, especially Kieve and Perry, as a result of their focus on the nationalisation of the industry in 1870. This emphasis on telegrams, referred to as public telegraphy, has created a historiographical distortion. My aim is to redress this distortion by bringing to light

[75] In this chapter I disregard private, point-to-point telephony which was still common during that period to concentrate on the role of telegraphic private wires in the development of exchange telephony. Private, point-to-point telephony is comprehensively addressed in Michael Kay's thesis. Michael A. Kay, 'Inventing Telephone Usage: Debating Ownership, Entitlement and Purpose in Early British Telephony.' (PhD thesis, University of Leeds, 2014).

private telegraphy, a second strand of telegraphy that co-existed with public telegraphy, and expose the dichotomy between public and private telegraphy, which I refer to as the duality paradigm.

To demonstrate this duality in the remainder of this thesis, I will deconstruct the Victorian telegraph. I will argue, first, that public telegraphy conveyed more the idea of continuity than change in the history of communication, as telegrams simply emulated letters. I will then form a detailed picture of private telegraphy and show its radical departure from contemporary postal services, thus contrasting public and private telegraphy. Finally, I will reveal how private telegraphy helped shape the contribution of the Post Office to the early development of exchange telephony, which again will reinforce the distinctiveness of private telegraphy.

With this thesis, I am therefore offering an important corrective to the history of the Victorian telegraph – one which, I hope, will encourage further research on the topic. For now, let's turn our attention to contemporary postal services.

Chapter 2. Haste! Post haste!

As shown in the introduction, historians of the Victorian telegraph have mostly confined their narratives to public telegraphy, and ignored the interplay between telegrams and letters. In drawing attention to postal services, in this chapter I seek to place the Victorian telegraph discourse in a wider context by providing an aperçu of postal services prior to the nationalisation of the telegraphs.

The study of the electric telegraph in isolation of contemporary postal services has also contributed to the belief that telegrams constituted a major discontinuity in the history of communication. Here, I provide evidence that by the time telegrams were introduced to the public in the late 1840s, letters were already a highly efficient form of personal correspondence; this will serve to reinforce the idea that a rivalry existed between the two types of communication.

From the very beginning, the Royal Mail was devised to convey letters as quickly as possible. This pursuit of speed and efficiency has led to the remarkable improvements that are described below. The purpose of this chapter is thus to demonstrate that the introduction of telegraphic communication, as an alternative to postal communication, was not as disruptive as is commonly believed: public telegraphy, as we shall see in the next chapter, conveyed more the idea of continuity than change in the history of communication.

In this abridged history of postal services, I look at the acceleration of the inland mail and expose the Post Office's quasi-obsession with the speed of collection, conveyance and delivery of letters. As will be seen in the next chapter, such improvements made telegrams only marginally more efficient than letters, especially over shorter distances.

In less than half a century, sweeping changes transformed the Post Office into an organisation providing mail services not only to the privileged few – those who had (free) franking rights – but also to the public at large; and this radical transformation preceded by several years the establishment of the telegraph industry. I also examine the urban posts, and especially the London District Post, as its concept was later emulated by a telegraph company that will be studied in more detail in Chapter 4.

The chapter has three main sections: the first (**'In the pursuit of speed'**) explores the evolution from mail-coaches to mail-trains, the second (**'Proximity and ubiquity'**) explores the London District Post and other penny posts, and the third section (**'Simple and affordable'**) looks at the implementation of Rowland Hill's innovative concept of a uniform penny postage – a flat rate idea later borrowed by one of the private telegraph companies. Particular attention is given to the organisation of the Post Office, and the way it organised its activities to collect, convey and deliver mail to customers: the network of local post offices, the end-to-end delivery process, use of railways and other means of conveyance.

Before turning our attention to the investigation of mail services however, we must remind ourselves of the broad social, economic and political forces that shaped the period during which the acceleration of the mail took place, to provide a backdrop for the exceptional growth in written communications that occurred in the nineteenth century. These were the days of Chartism, the reform of the Poor Law and the repeal of the Corn Law amongst other turbulent events, and newspapers and letters were the main conduit for carrying such news across the country. Literacy was on the rise, reading if not writing, thanks to changes in the education system which saw Sunday schools turned progressively into weekday schools run on the monitorial system, the phenomenal growth of the National Society for the Education of the Poor (amongst other schools operated by voluntary societies), and increased government funding for education.[76] At the same time the population grew from 13.9 million in 1831 to 20 million in 1861, and this demographic trend was accompanied by an increase in urbanisation, reaching nearly sixty per cent of the population in 1861, as well as an increase in mobility facilitated by more convenient and faster forms of transport.[77] Whether it was the acceleration of the mail, the demographic explosion, increased literacy, the growing middle class or, more likely, a combination of these and other factors, the volume of letters increased from 67 million letters posted in 1839 to 242 million in 1840, 457 million in 1855 and 741 million in 1865, with nearly twelve per cent (86 million in 1865) of these letters handled by the London District Post alone (that is, letters posted in the capital and delivered to a metropolis address).[78] Letters, said

[76] In 1830, there were 3,670 schools run by the National Society for the Education of the Poor in the Principles of the Established Church, representing some 346,000 children in attendance. Many schools were run on the monitorial system in which older or brighter students taught the younger or less able pupils. By 1851, there were 17,015 Church schools with 955,865 children and a further 1,500 British schools with an estimated 225,000 children. The first government education funding in 1833 was a modest £20,000, but in 1858 the grant totalled £700,000. Trevor May, *An Economic and Social History of Britain, 1760-1990*, 2nd ed. (Longman, 1996), 160.

[77] Asa Briggs, *A Social History of England* (London: Book Club Associates, 1983), 245.

[78] The figures for the years 1839 and 1840 were sourced from the work of Julian Stray, Assistant Curator at the British Postal Museum & Archive, while the totals for the years 1855 and 1865 were extrapolated from Post 19/91. Julian Stray, *Post Offices* (Oxford: Shire Publications Ltd, 2010), 12. ‘A Statement of the Number of Letters, Book Packets and Newspapers Delivered in the UK in One Week of Each Calendar Month, 1855-1876’, Post 19/91, BPMA, accessed 21 March 2014.

Golden, were knit into the fabric of the lives of ordinary citizens and famous Victorians.[79] For her, it was the decrease in postage rate that gave rise to a wider use of letters, including business correspondence, messages of condolence or congratulations, invitations and other written communications. In 1854, for instance, the annual volume of correspondence was equivalent to sixteen letters per person, and this ratio increased to twenty-two letters per person in 1863.[80]

2.1. In the pursuit of speed

> The safe and speedy conveyance of letters, for the benefit of trade and commerce, was the primary consideration with the Government on the first establishment of a General Post-office.[81]

As can be seen in the epigraph, the opening sentence of the tenth report into the management of the Post Office, speed was clearly an important consideration when dealing with the conveyance of letters. It is interesting to note that for a mathematician and philosopher like Charles Babbage this quest for speed was also an appealing challenge. In 1832, he published the notes he had taken while visiting workshops and factories across Britain and the Continent as part of his research and development of the 'calculating engine'. These were thoughts about how to improve the efficiency of various industrial and commercial processes through the use of machinery, automatons and other time-saving mechanisms.[82] The conveyance of letters, we learn from one of

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[79] Catherine Golden J., *Posting It - The Victorian Revolution in Letter Writing* (University Press of Florida, 2010), 19.

[80] 'First Report of the Postmaster-General on the Post Office', 1855. 22.

[81] 'The Tenth Report of the Commissioners Appointed to Inquire into the Management of the Post-Office Department', 1838.

[82] In the third edition of this publication, Babbage lists 467 of these thoughts, and it is fitting for this thesis on the electric telegraph (and the transmission of intelligence) that thought number

these thoughts, could be accelerated by the adoption of a mechanical system that would transport the mails between post-towns.[83] For Babbage, the speed at which the mail was currently being conveyed was optimal, and no further significant improvement could be expected unless machinery replaced horses.[84] His idea was to erect, at regular intervals between these towns, high pillars that held a strong metallic wire stretched between small station-houses three to five miles apart. A smaller endless wire attached to rollers positioned on the stronger wire would be used by the station-house attendants to pull tin cylinders carrying the mail across the segments using an appropriate mechanism. Besides speeding up mail delivery, the system would also allow for two or three mail deliveries per day at minimal expenses, and even the transmission of 'expresses' at any time of the day or night, should the attendants be residing in the stations.[85] Two other significant ideas were mentioned by Babbage as part of this concept: the first was a reference to a possible use of the wires for telegraphic communication, and the second was the use of church steeples and other high buildings

465 (his vision of the future) concludes that 'knowledge is power'. Charles Babbage, *On the Economy of Machinery and Manufactures*, 3rd ed. (John Murray, 1846).

[83] The concept is described in item 334 (Ibid., 273.) It is interesting to note that this idea was also discussed in: Charles Babbage, *Passages from the Life of a Philosopher* (London: Longman, Green, Longman, Roberts, & Green, 1864), 447. In this latest work, we also learn that Babbage discussed the concept of uniform rate of postage with his friend General Thomas Frederick Colby at or about the time of the Irish survey (c. 1824) some fifteen years before Rowland Hill's reform.

[84] Charles Babbage had not yet heard, apparently, about the Liverpool & Manchester Railway which had already started to convey mail as early as 1830, as will be seen later in this chapter.

[85] 'Expresses' were urgent messages despatched by messenger at any time of the day or the night with the famous marking "Haste! Post haste! ", with a way bill accounting for the time taken to complete the journey. According to Lewins, expresses were charged a shilling a mile, and the speed at which they travelled averaged 10mph. William Lewins, *Her Majesty's Mails - a History of the Post Office, and an Industrial Account of Its Present Condition.* (London: Sampson Low, Son, and Marston, 1865), 290.

to stretch the wires in an urban environment. It should be remembered that Babbage wrote these thoughts before the age of the electric telegraph. These were the days when Francis Ronalds was experimenting with a Canton's pith ball electrometer charged by a Leyden jar as part of his efforts to design a working electric telegraph in his home in Hammersmith.[86] Moreover, as we shall see in the next chapter, Babbage's vision of wires stretched across house-tops and church steeples would soon become a reality.

Nevertheless, insofar as the conveyance of mail was concerned, the pursuit of speed and efficiency was not specific to the nineteenth century. From the time Charles I proclaimed in 1635 that his Royal Mail service could also be used for private purpose, albeit at great expense to the recipient, the efficiency of inland mail services have been the subject to many incremental improvements. In the beginnings, mails were carried by messengers riding post horses along roads with staging posts. All the letters were sent initially via London, but in 1720 cross-posts were established by Ralph Allen to allow mails to be sent directly from one post town to another without transiting through London, thus reducing transit time between post towns.[87] Letters were dropped in 'letter receiving houses' (for the most part these were inns) and from there transported to post towns where mailbags were assembled to be carried by messengers on horseback. The average speed of these messengers (often 'idle boys mounted on worn hack') was three to four miles per hour.[88] As an illustration, the time to convey mails

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[86] Sir Francis Ronalds, *Description of an Electrical Telegraph and of Some Other Electrical Apparatus* (London: R. Hunter, 1823).

[87] Historical summary in: 'First Report of the Postmaster-General on the Post Office',1855. 8.

[88] Ibid., 16.

between London and Bristol, a distance of 122 miles, ranged typically between twenty-five and thirty hours.[89]

An important improvement to the conveyance of the mail was made in 1794, under the auspices of John Palmer, Surveyor and Comptroller-General of the Post Office: initially, he sought to send the mailbags by (passenger) stage coach, accompanied by armed guards to prevent the all-too-frequent robberies of mails when they were carried by the messengers on horseback. The speed of the mail was immediately increased to more than six miles per hour, and with the development of specific mail-coaches it gradually increased to ten miles per hour, and even more with improvements in road making.[90]

Palmer's mail-coaches thus replaced the messengers on horseback and the post boys on their slow-moving horse-drawn mail-carts. Mail-coaches were smaller than stage coaches, and used four horses instead of six, but as the horses were replaced every 10 to 15 miles – a shorter interval than for the stage coaches – they were going at greater speed. Mail-coaches were also travelling night and day, and were exempt from stopping at turnpikes for the payment of tolls. The times of arrival and departure were now strictly controlled via a travelling clock under the safekeeping of the mail-coach guard and written down on a time-bill.

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[89] Joseph Clarence Hemmeon, 'The History of the British Post Office', *Harvard Economic Studies* 7 (1912): 100.

[90] Two Scottish engineers, in particular, were behind these improvements: John Loudon McAdam for road surfacing, and Thomas Telford for infrastructures such as bridges. Stanley Harris, *The Coaching Age* (London: Richard Bentley and Son, 1885), 32. According to Simmons, in 1826 the fastest mail coach reached a speed of 14 miles per hour on the road from Liverpool to Manchester. Jack Simmons, *The Victorian Railway* (Thames and Hudson, 1991), 219.

In 1797, a time-bill for London to Bristol in summer time showed a departure from the General Post Office at 8 p.m., an arrival at Brentford at 9:20 p.m., then Thatcham at 2:45 a.m., and Marlborough at 5:45 a.m., before finally arriving in Bristol at 11 a.m., a total of fifteen hours.[91] Later, with further improvements, the same journey was covered in thirteen to fourteen hours, less than half the time it took when the mail was carried by messengers.[92]

The letter receiving houses were at this point increasingly referred to as post offices. The General Post Office also established 'forwarding' offices, usually located in the centre of towns, every 100 miles or so (or where best positioned) on the coach routes for sorting and distributing the mail from the area.[93] It was there that mail-coaches stopped for delivering the mailbags. These post offices maintained private boxes for the merchants of the town, as well as private bags for the local gentry and those who could afford the expenditure. Everyone else had to come to the post office in town to pick up their mail in 'poste restante', where letters often remained for days, and sometimes weeks.[94] The letters for the rural districts around the town were collected, grouped by destination or road, and distributed via private carrier at a charge of a penny when their number reached a certain threshold.[95]

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[91] Edmund Vale, *The Mail-Coach Men of the Late Eighteenth Century* (Newton Abbot: David & Charles, 1967), 233.

[92] Hemmeon, 'The History of the British Post Office', 105.

[93] Julian Stray, *Mail Trains* (Oxford: Shire Publications Ltd, 2012), 11.

[94] As we shall see later in this chapter, 'poste restante' was subsequently used to send telegrams to recipients in places not served by the telegraph companies.

[95] Lewins, *Her Majesty's Mails*, 289.

By 1797, according to Lewins, mails were conveyed in one half of the time taken in the early period of the mail coaches, in some cases even in one-third of the time, and on the cross-roads in a quarter of the time taken under the old system. By 1820, all post roads had been macadamized for added efficiency. Palmer's mail-coaches, as well as all stage coaches carrying Royal mails, were also exempt from tolls at turnpikes, which improved further their average speed.

As the mail-coaches crisscrossed the country delivering mailbags to post towns, another innovation in transport was incubating: the steam engine era had begun. The first fully mechanised rail transport system, the Stockton & Darlington Railway, was inaugurated in September 1825. The line sat between Stockton-on-Tees, near Middlesbrough, and ran to Darlington, 25 miles further to the West. Originally conceived to carry coal, the Stockton & Darlington Railway opened its service to passengers just one month after its opening, on October 10, 1825.[96] The speed of the train was a modest eight miles per hour, but this innovation had yet to show its full potential for transporting passengers, goods and even intelligence.

On 9 September 1830, exactly five years after the opening of the Stockton & Darlington Railway, the Liverpool & Manchester Railway began its operation. This railway was designed from the start to carry passengers, and their adoption of this new

[96] According to *The Leeds Mercury* dated 8 October 1825, for the opening of the service, the train (conducted by Mr Stephenson himself) consisted of 38 carriages, including the locomotive and its tender, and carried at least 550 passengers in 22 carriages, together with coal, flour and other goods. See also Stray, *Mail Trains*, 5.

mode of transport was rapid.[97] It so happened that the Post Office struggled with mail delivery operation in that area, and the Liverpool & Manchester Railway was proposed as an alternative to mail-coaches.[98] On 11 November 1830, the line began to carry mail between Liverpool and Manchester – thus inaugurating the mail train era. By 1836, the Post Office operated day and night a mail service on this line, with the trains covering the distance of 30 miles at a maximum speed of 20 miles per hour.[99]

At first, the mail-coaches, complete with mail and staff, were loaded on to the trains, but soon, only the mailbags and the guards were transported. According to Stray, the idea of sorting letters along the road in specially fitted mail-coaches had been floated by Rowland Hill as early as 1826, but it was the Post Office Surveyor George Karstad who, in 1837, suggested a special railway carriage for sorting mail en route. The idea was successfully tested in January 1838 between Birmingham and Liverpool on the Grand Junction Railway, and in August of that year the Post Office made railway post offices an integral part of its operation: the 'Mails on Railways' Bill (2 Vic. Cap.98) received Royal assent on 10 August 1838. It made it compulsory for the railway companies to provide a separate carriage for sorting letters or to convey mail by ordinary trains, if more appropriate, in return for a reasonable financial

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[97] According to the *Morning Post* dated 7 October 1830, just one month after its opening, the Liverpool & Manchester Railway was already transporting an average of 763 passengers per day.

[98] The struggle was actually not limited to that particular area, as the volume of mails was increasing everywhere in the British Isles.

[99] Stray, *Mail Trains*, 5.

compensation.[100] On board the separate carriages, the letters were sorted by clerks, while the mail guards were responsible for closing, despatching and receiving mailbags, as well as filling out the time-bills.

The take-up of mail-trains by the Post Office was very fast. For instance, when the London & Birmingham Railway opened on September 17, 1838 the Post Office began sending mail by rail immediately; initially between London to Denbigh Hall near Bletchley.[101] The following year, two mail-trains were running each day in both directions between London and Lancaster, and the frequency increased progressively, reaching eight mail-trains per day on that line in 1864. By that time, the trains were running twice as fast at forty miles per hour on some lines, although the mail-train between London and Bristol (a distance of 118 miles) ran at an average of thirty miles per hour in 1860, and the conveyance of mails between these two places took slightly less than four hours – yet another major improvement over the fastest mail-coaches which had covered the distance in thirteen to fourteen hours at the beginning of the century.[102] However, the Post Office was concerned by the lack of punctuality of certain trains, because the efficient transfer of mailbags between trains required compliance

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[100] As mentioned in *The Times* dated 11 August 1838, however, the Act did not specify a rate of payment, which led to numerous disputes between the Post Office and the railway companies. These were resolved through arbitration, often to the advantage of the railway companies. As the cost of railways skyrocketed, it became a point of contention following the implementation of Hill's reform.

[101] Stray, *Mail Trains*, 9.

[102] See time-bill for London and Exeter: 'Specimen Railway Time Bills with Current and New Schedules, England, Wales and Scotland 1859-1861', 89, Post 11/42, BPMA, accessed 15 July 2014. See also: Lewins, *Her Majesty's Mails*, 280.

with published timetables.[103] To compound the problem, the Post Office had to deal with a very large number of railway companies.[104] For the year 1853, for instance, the mail was carried on 206 lines belonging to 62 railway companies – 38 in England and Wales.[105] But despite the challenge of dealing with a large number of railway companies, the Post Office took advantage of the explosive growth of the railways.[106]

The efficiency of the mail service improved significantly during that period, and this progress can be attributed to three factors: first of all, mail-trains were transporting mail at a significantly higher speed than mail-coaches; second, the expansion of the railways and the extraordinary capillarity of the rail network made the conveyance of mail between post towns more direct, bypassing the transit via London in many cases; and finally, important innovations and process improvements drove further economies of time.

Amongst these important innovations were the Travelling Post Offices (TPO). These were specially fitted carriages, dedicated to sorting the mail in transit, and each

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[103] Slower special mail trains were more reliable than the faster passenger trains, which also carried mail but were more expensive to operate. The situation was particularly dire for mails posted in London for the North of England or Scotland, and a Select Committee was appointed in 1854 to 'inquire into the Postal Communication between London and the Cities of Edinburgh and Glasgow, with a view of ascertaining whether greater despatch and punctuality can be attained in the transmission of letters'. See Hansard: 'Postal Communication between London and Scotland' (HC Deb Vol 131, 7 March 1854).

[104] Perry estimated that carrying a single letter from Land's End to John O'Groats would have required a contractual arrangement with twenty one separate railways. Perry, *The Victorian Post Office*, 206.

[105] Stray, *Mail Trains*, 12.

[106] In 1843 there were 1,857 miles of railways, and by 1847 the total mileage had reached 3,036 miles. This will increase to 16,000 miles of railway in the United Kingdom by 1872. Harris, *The Coaching Age*, 426. William H. Preece, 'On the Block System of Working Railways', *Journal of the Society of Telegraph Engineers* 2 (1873): 233.

TPO functioned as a sorting office with its own clerks and sorters.[107] For the London-originated mail, for example, the sorting of the letters started at exactly 6 p.m. at St Martin's-Le-Grand.[108] This was a two-step process: the letters were first sorted into twenty eight broad destinations, and each destination was then split into another twenty eight further destinations known as 'roads', which were large towns along a given railway line (for instance, letters to Derby, Loughborough, Nottingham, Leicester and Lincoln were grouped together).[109] At 8 p.m. approximately, the letters for each of these towns and their districts were sealed into mailbags and despatched by mail-vans to one of London's railway terminals, to be loaded on-board the suitable train. All the other letters needed additional sorting.

The mail-coaches had to stop for thirty minutes or so in each post town along the route to allow the mail for these towns to be extracted, and this process occasioned additional transit delays.[110] With the TPO, however, the sorting began at around 8:30 p.m. as the train was steaming along the 'road'. Inside the special carriage, the letters were sorted by town and placed in individual mailbags. Moreover, the trains did not stop at railway stations to deliver these bags and pick-up others as a second important innovation allowed the train to steam past the stations while a device took care of the exchange of bags.

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[107] Lewins, *Her Majesty's Mails*, 269.

[108] The General Post Office's headquarters relocation to St Martin's-Le-Grand (from Lombard Street) was completed on 23 September 1829. Herbert Joyce, *The History of the Post Office from Its Establishment down to 1836* (London: Richard Bentley & Son, 1893), 410.

[109] Lewins, *Her Majesty's Mails*, 268.

[110] For smaller towns and villages, mailbags were held from a balcony of an inn and snatched by guards as the mail-coach passed by.

No name has ever been given to this device, but Lewins thought that it may have been invented and improved by Messrs Ramsay, Dicker and Pearson of the Post Office.[111] The device was in two parts: the first part was bolted to the side of the carriage, the second part installed alongside the track. The sorted bags, now enclosed in a protective leather pouch, were pushed outside the carriage into a contraption which allowed the bags to be snatched by a mechanism beside the track as the train passed by at speed. Similarly, mailbags could also be transferred to the TPO by hanging them on a crane of sorts by the side of the track, there to be hooked and pulled aboard the speeding train.

As the mailbags were dropped in the railway stations along the route, another sorting process would then take place. Typically, a mail-cart delivered the mailbag from the station to the local post office where the letters were then stamped, sorted and arranged in different boxes or bags. Letters to be distributed by letter-carriers were further arranged by these employees by order of delivery from house to house. Letters for remote villages and other smaller towns in the district were bundled together to be despatched to the sub-postmasters – some by mail-gigs, others by local railways. Letters for the country gentry were delivered by one of the clerks as soon as possible.[112]

The Post Office, as we have seen above, strived to increase the speed at which the mail was conveyed. In a span of fifty years, the speed increased tenfold, from three to four miles per hour to in excess of forty miles per hour. The 122 mile road journey (118

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[111] By 1864, more than one hundred stations were equipped with this device. Lewins, *Her Majesty's Mails*, 283.

[112] At an annual fee of one guinea in 1864. Ibid., 293.

miles by rail) between London and Bristol which originally took up to thirty hours on horseback was, by 1860, taking less than four hours using the mail-trains. This economy of time was made possible by the rapid adoption of rail transport, and also by innovations such as the Travelling Post Offices, where sorting was taking place while the train was steaming ahead, and the automated exchange of mailbags that allowed the trains to pursue their journey at speed while delivering and picking up mail. A letter could now be sent from Bristol by night train, and delivered to a recipient in London by 9 a.m. the following morning.

2.2. Proximity and ubiquity

If technological innovations (such as the mail-train) were behind the acceleration of the mail between towns, technology seems to have played a lesser role within towns.[113] Mail efficiency in the urban space was improved primarily via novel processes

[113] With the notable exception of urban pneumatic systems: according to Rowland Hill's memoirs, 'tubular conveyance' (as pneumatic systems were then called) for transporting mails between districts was studied in the 1850s at Hill's request by two engineers (Charles H. Gregory and Edward A. Cowper). Cowper produced a report in 1859 that described an air-pump that created a vacuum in a pipe with the effect of propelling objects at speeds up to 150 miles per hour. The concept was dropped by the Post Office because it was found to be even more expensive than a railway line of equivalent distance (Rowland Hill and George Birbeck Hill, *The Life of Sir Rowland Hill and the History of Penny Postage* (London: Thos De La Rue, 1880), 336.). On 13 August 1859, however, the Pneumatic Despatch Company was formed (22 & 23 Vic. Cap.137) and given power for five years to open and break-up the streets to convey 'parcels, despatches and messages' paid for directly by the public (for parcels) or, at a much reduced rate, by the Post Office (for mails and post letter bags). A line half a mile long was laid down between Euston station and the North Western District Post Office. The Acts 27 & 28 Vic. Cap.130 (1864) and 35 & 36 Vic. Cap.180 (1872) extended the power, the latter enabling the company to connect their undertaking with the railways in the metropolis, for instance from the company tube in Tottenham Court Road to the Great Northern Railway (St Pancras) and the Great Western Railway (Paddington).

and organisational arrangements – in particular, the penny posts.[114] As the towns grew in size, population and prominence, the communication of intelligence within these commercial and industrial centres was of prime importance. We shall see in the next chapter that the electric telegraph technology was successfully applied to an urban communication system, but in this section I show that the Post Office had implemented in London such a system long before the telegraph era.

The first British urban post is often credited to a merchant called William Dockwra who, in 1680, established a private penny-post system in London.[115] This system was short-lived as the Post Office considered it a breach of its monopoly on letters and brought about its closure two years later. However, it was re-established in 1697, this time as a distinct department of the Post Office, and with Dockwra as its controller. The concept of the penny-post for the metropolis called for the subdivision of London into 'districts', each acting as a head office with sorting facility.[116] A large network of letter-receiving houses spread across the capital, often small shops, which acted as collection points for the letters to be sent to recipients across the capital.[117] The headquarters of the Post Office in London acted as a central clearing house for the districts' post offices.

[114] The Postage Act 1765 (5 Geo. 3. Cap.25) authorised the Post Office to establish the penny posts for 'the conveyance of letters beyond the post town to which they were directed'.

[115] Stray, *Post Offices*, 7.

[116] In 1856, the subdivision of London was later restructured into ten postal districts named SW, SE, WC, EC, E, N, NW, W, NE and S, according to their compass bearing from St Martin's-Le-Grand with the latter two later amalgamated into the districts E, SW and SE. Campbell-Smith, *Masters of the Post*, 147.

[117] There were 148 such receiving houses in 1830 (in 1837 that number had increased to about 200, which was in addition to the 70 receiving offices for the general post). It was not until 1852 that free-standing 'pillar boxes', or 'road-side letter boxes' as they were initially called, were introduced by Anthony Trollope to collect letters, first in Saint Helier in the Channel Islands on 23 November 1852, and then in London. Trollope apparently picked up the idea

Figure 2.1. A pillar box in Fleet Street, London – one of the first to have a pillar box in 1855. A plaque commemorates the bicentennial of the birth of Anthony Trollope (1815-1882).

Initially, the London Penny Post had been set-up in the cities of London and Westminster, as well as the borough of Southwark and their suburbs, before being extended to a radius of ten miles around the City. Later, with an additional fee of one penny, letters could also be delivered beyond the original limits. With the Postal Act 1801, the conveyance of a letter by the general post to London and its subsequent transfer for delivery to one of the districts for delivery by the penny-post cost two pence:

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from France. M. M. Raguin, *British Post Office Notices 1666-1899*, vol. 5 (1850-1859) (Published by the author, 1991), 79. and also: Lewins, *Her Majesty's Mails*, 144. The number of London receiving houses for both the general post and the Twopenny Post is indicated on page ix of the third report of the Select Committee on Postage (1837).

the London Penny Post had become the Twopenny Post. The Postal Act 1805 set further rates for letters sent and delivered within the districts.[118]

The Twopenny Post had two principal offices, one in Lombard Street, close to the general headquarters at St Martin's-Le-Grand, the other in Gerrard Street in Soho. It organised its districts into two divisions: the town division (which was limited to a three mile radius around the general post central office) where, in 1830, 224 letter-carriers made their 'walks' on foot, and the country division (with a twelve mile radius) where 189 letter-carriers made delivery either on foot or on horseback (there were thirty horses assigned to this task in 1830).[119] There were also horses (six in 1830) for carrying mails to be exchanged between the districts, and these were required to be of sufficient fitness to average a speed of eight miles per hour. The charges were two pence for letters distributed within the town division (with a maximum weight of four ounces), three pence for letters to or from a country division (hence the Threepenny Post), and two pence to be added to the rate of the general post for those letters conveyed to London and delivered using the twopenny post. According to Thomas Moore Musgrave, comptroller of the Twopenny Post Office (renamed the London District Post Office in 1844), who was called in as a witness during an enquiry into the Post Office revenue in 1830, there were six daily collections and deliveries of letters in the town division, and three such daily occurrences in the country division, in places such as Hackney. The

[118] 'Twenty First Report of the Commissioners of Inquiry into the Collection and Management of the Revenue - Part IV Twopenny Post Office' (House of Commons, 24 February 1830), https://archive.org/stream/op1244610-1001/op1244610-1001_djvu.txt.

[119] Ibid., 36. The quoted numbers of letter-carriers include 40 supernumeraries for the town division and 24 for the country division. In July 1841, the number of letter-carriers had increased to almost 600. 'Memoranda Book Relating to Administration and Organisation of the Twopenny Post Office (c.1829-1856).', 42, Post 14/3, BPMA, accessed 3 July 2014.

receiving houses were opened for collection between 8 a.m. and 8 p.m. while the two principal offices collected continuously the letters between 9 a.m. and 9 p.m. For the town division, the deliveries took place at 8 a.m. (for the previous day late mail), 10 a.m., 12 noon, 2 p.m., 4 p.m. and 7 p.m., and all the delivery walks were completed within an hour. For instance, letters stamped at 10 a.m. were delivered at noon, etc., and those stamped at 7 p.m. were delivered first thing next morning. In effect, a posted letter could be received in as little as three hours within the metropolitan area, for as little as two pence. The system was further improved in 1843 when additional letter-carriers and sorters made possible eight deliveries per day in the town division: there were three deliveries in the morning and five after noon, the last one being at 8 p.m. (outside the three mile circle, the number of deliveries also increased to up to six per day dependent upon the distance, with four daily deliveries beyond the six mile demarcation).[120]

The London District Post was not unique. Francis Freeling, Secretary of the Post Office from 1797, was an ardent promoter of penny posts in towns across the country, although he also opposed a reduction in postal rates and even attempted to raise their tariffs. By the end of 1793, Manchester, Bristol and Birmingham had already set up their own.[121] Under the influence of Freeling, many others followed, including the one established in 1833 in Stockton-on-Tees, where in its first year of operation 7,100 penny post letters had been posted.[122]

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[120] 'Report on the London District Post (Report from the Select Committee on Postage - Appendix 14)', 14 August 1843. 118. Prior to eight deliveries per day, an intermediate 7th delivery was commenced on 14 November 1837 ('Memoranda Book Relating to Administration and Organisation of the Twopenny Post Office (c.1829-1856).').

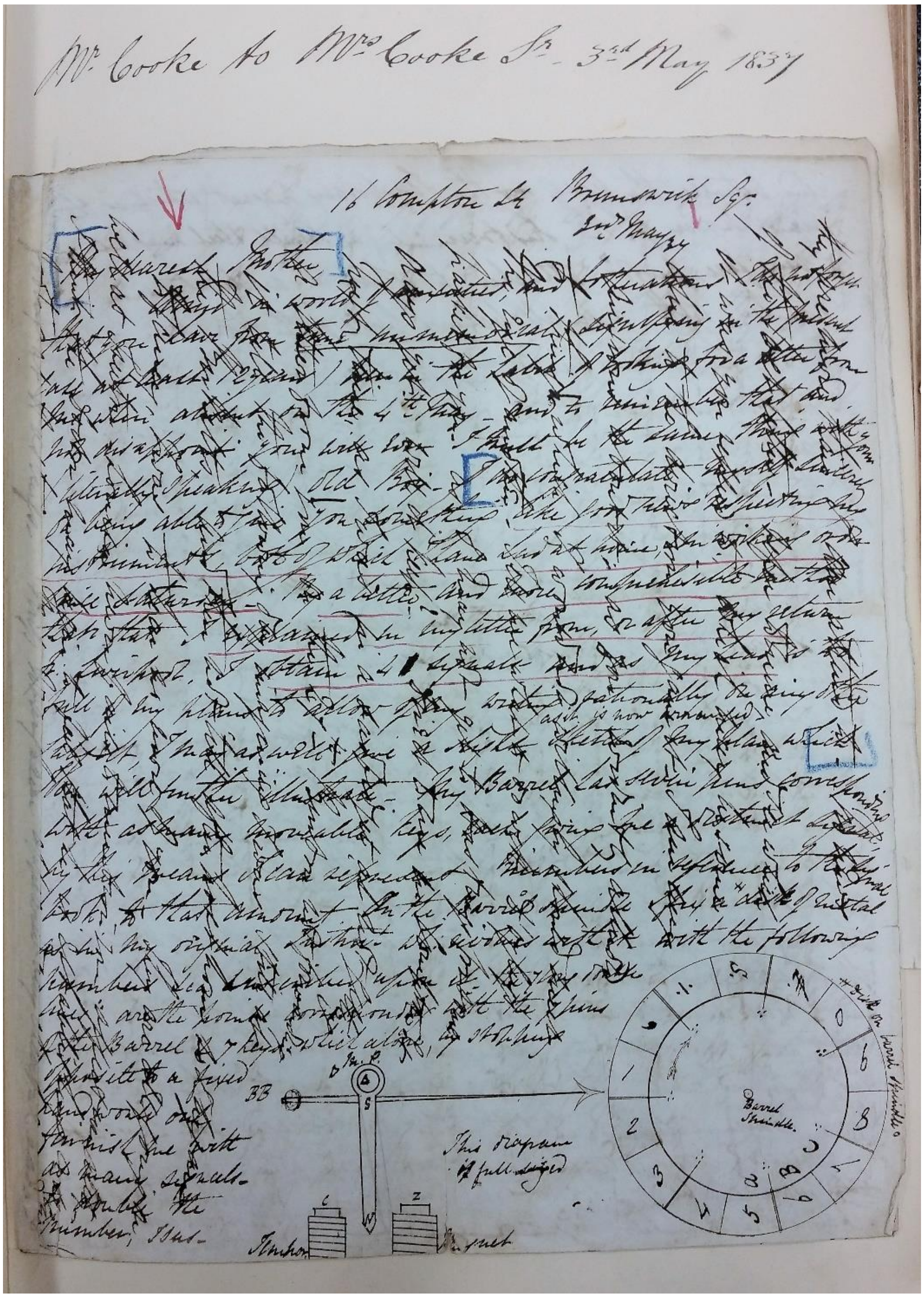
[121] Campbell-Smith, *Masters of the Post*, 107.

[122] Stray, *Mail Trains*, 5.

However, the penny posts were a partial and unequal system, and this situation, together with the persistent grievances from the public with regard to the general post, led to a reform that will now be examined below.

2.3. Simple and affordable

The complexity of the tariffs and the postage cost were at the root of the criticisms faced by the Post Office. Postage was calculated according to distance. However it was not based on the most direct route between the place of origin and destination of a letter – instead it took into account the carrier's journey, which was often a circuitous route optimised for the convenience of the Post Office. Moreover, the cost was also dependent on the weight and the number of sheets of paper, and it was common in those days for correspondents to attempt reducing the number of sheets. When writing to his mother, for example, William Fothergill Cooke often wrote in the margins, as well as vertically or diagonally (see Figure 2.2. below). Also, delivery could be free in some areas and chargeable in others. Sending a letter was an expensive and convoluted operation.



Mr Cooke to Mrs Cooke Sr. - 3rd May 1837

16 Compton St Brunswick Sq

Figure 2.2. Example of cross-writing: a letter from William Fothergill Cooke to his mother, dated 3rd May 1837. Photograph reproduced with the kind permission of the IET. The brackets were added during a transcription, the result of which was first published in 1895 and later reprinted in 2013: '… I do congratulate myself sincerely on being able to give you something like good news respecting my instruments, both of which I have had at home and in working order since Saturday…' [123]

[123] 'Cross-Writing: Cooke's Letter to His Mother' 3 May 1837, SC MSS 7 (Box 1, Volume 4), IET. F. H. Webb, ed., *Extracts from the Private Letters of the Late Sir William F. Cooke* (Cambridge University Press, 2013), 24.

The situation led to a large number of petitions being filed in support of the reform advocated by Rowland Hill, a reform he had outlined in a pamphlet published in early 1837 – two years before his appointment as Adviser to the Treasury, charged with implementing this reform.[124] 320 petitions were received, for example from towns, chambers of commerce, insurance companies, printers and publishers, merchants, and bankers, altogether representing 38,709 signatures.[125] There was also a petition from the City of London which had long lobbied for reduction in postage.[126]

A House of Commons Select Committee established in 1837 was given the mission to 'inquire into the present rates and mode of charging postage, with a view to such a reduction thereof as may be made without injury to the Revenue'. Its chairman was Robert Wallace, MP for Greenock, and a fervent supporter of Hill's reform proposal.[127] Despite a strong resistance from Post Office officials, the opinion of the Committee in favour of the reform prevailed.

Two key recommendations were made. The first, and the most radical, was the abolishment of distance-based pricing for inland postage: a uniform charge was to be introduced regardless of the distance the letter had to travel to reach its destination. It had been found that the distance had much less impact on the cost of carrying letters than previously thought; the main factor was the volume of letters, and the cost was

[124] Rowland Hill, *Post Office Reform - Its Importance and Practicability*, 3rd ed. (London: Charles Knight, 1837). Campbell-Smith, *Masters of the Post*, 132.

[125] 'Third Report from the Select Committee on Postage', 13 August 1838. 3.

[126] 'Petition from Mr Grote', *The Times*, 25 November 1837, 3.

[127] Robert Wallace also presented two petitions to the House of Commons in favour of Rowland Hill's plan for the reform of the Post Office. 'Petition from Mr Wallace', *The Times*, 12 December 1837, 3.

actually greater for short distances than it was for longer ones. However, it would have been difficult, if not impossible, to convert such a model into practice, and the most practical (and fairer) alternative was therefore a uniform rate of postage, regardless of the distance between the towns.

The second recommendation, perhaps the most innovative and unquestionably the most effective in terms of acceleration of mails, was grounded on the hypothesis that the cost of handling a letter could further be reduced if payment was made in advance, that is, if the postage was paid by the sender and not by the recipient of the letter. Letters were then to be delivered without having to collect money, which simplified and sped up the delivery process, while reducing the complexity of the accounting process at both central and local levels. The method proposed for implementing such a system was by means of stamps which would, in effect, be equivalent to the act of franking the letters by the members of Parliament, bishops and other privileged individuals (which consisted simply in the writing of their names on the envelope). The significant cost reduction expected from the adoption of pre-payment, especially when coupled with the other cost-cutting measure mentioned above, would make it possible to reduce the rate of postage. Payment on delivery would still be possible, but at a higher rate, as this was meant as a disincentive. The recommendation also described how this concept could be implemented, with prefabricated small bits of paper just large enough to bear a stamp and covered at the back with a glutinous wash which could be attached to the letter with a little moisture – in effect, a description of the future penny black.

Further simplification of postal operations was recommended. One was the abandonment of a postage rate dependent on the number of sheets in favour on a regulation by weight to make it more acceptable and fairer to the public, as errors and fraud had been prevalent under the old system, and led to the practice of 'candling' letters: the opening of their wax seal by Post Office officials to discover any additional sheets wrapped inside the outer page.[128] This was perceived by customers as intrusive and a breach of their privacy.[129] The other was the proposal for hourly delivery of letters in London by combining the letter-carriers of the general post and the district post.[130]

The opinion of the committee's members was divided, with four in favour and four against; but the presence of Wallace in the chair led to the motion being adopted and presented as such to the Treasury.[131] Despite opposition from Post Office officials, a Penny Postage Bill was introduced in July 1839, and given Royal assent four weeks later. On 16 September 1839, Rowland Hill was appointed as an adviser to the Treasury, with the mission to improve postal service by introduction of 'uniform penny postage'.

The reform was officially launched on 10 January 1840, initially with a temporary pre-payment system that did not employ paper stamps. The uniform postage that Hill had recommended hitherto was set at one penny for letters weighing no more than half-ounce, and an extra penny for letters weighing more than half-ounce but not exceeding one ounce.[132] This gave time for the firm of Perkins, Bacon & Petch to produce the penny

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[128] Campbell-Smith, *Masters of the Post*, 126.

[129] The practice continued after the reform, which led to further controversy and a debate in both Houses of Parliament in 1844 and 1845.

[130] Hansard: 'Postal Reform - Mr R Hill' (HC Deb Vol 70, 27 June 1843).

[131] 'Third Report from the Select Committee on Postage', 13 August 1838. iv.

[132] For delivery within a 15 mile radius from where the letter was posted no additional charge was imposed (unless not paid in advance, in which case the rate was two pence). For posting and delivering beyond the limit of 15 miles a charge of two pence was enforced. But by 1864,

blacks, which were introduced in May 1840, soon followed by the twopenny blues.[133] After the invention of the envelope folding machine by Messrs De La Rue in 1846, the use of envelopes became increasingly common.[134]

The reduction in the rate of postage, pre-payment and other simplifications under the postal reform opened the world of written communication to a broader public, leading to an increase in letter-writing. The reform had indeed a tremendous impact on the volume of correspondence. In 1839, the committee had estimated that the number of chargeable letters passing through the post offices of the United Kingdom was between 75 and 80 million, of which about 57 million were general post letters, and the remainder were penny, twopenny, and threepenny post letters; while the number of franks was about seven million. During 1840, the number of chargeable letters grew to a staggering 168.8 million, and the growth continued unabated with 347 million such letters in 1850 and 570 million in 1860.[135]

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almost 95% of letters were delivered free to their postal addresses, with no special fee beyond the postage stamp. Campbell-Smith, *Masters of the Post*, 146.

[133] About a year after releasing penny blacks, the Post Office replaced them with penny reds, as they offered a better contrast when obliterating the stamps.

[134] The machine automatically folded them, and applied glutinous wash to the back of the flap. The machine presented at the Great Exhibition of 1851 was able to produce 2,700 envelopes per hour. It is also interesting to note that Messrs De La Rue were awarded a contract in 1853 for making stamps using surface printing, a cheaper typographical process. Asa Briggs, *Victorian Things* (London: Penguin Books, 1988), 356. See www.delarue.com/timeline/index.html and www.postalheritage.org.uk/page/victorian-machines, last accessed 4 July 2014.

[135] 'A Statement of the Number of Letters, Book Packets and Newspapers Delivered in the UK in One Week of Each Calendar Month, 1855-1876'. 'First Report of the Postmaster-General on the Post Office', 1855.

However, a controversy arose regarding the loss of income incurred by the Post Office following the implementation of the reform.[136] The cost associated with the uniform penny postage and the prepayment approach, claimed the old guard at the Post Office (those who had opposed Hill's plan), was the main reason behind this decline. In response, Hill argued that the situation was caused not by his plan but by the spiralling costs of conveying letters by railways. Even before the plan was implemented, he stated before a Select Committee on postage that the costs of the railways had risen steeply and would have continued to do so even without the penny postage.[137]

By the early 1840s the expenditure on trains was already twice as much as the expenditure on coaches, and the dramatic increase in the volume of letters was making the situation worse. One reason invoked by Hill for this high level of expenditure was the large number of railways that the Post Office had to deal with, and their diversity: while the cost of carrying mails by coaches averaged less than three pence a mile, the cost of transport by railways varied between six pence and five shillings per mile.[138] Most agreements were settled in arbitration, usually in favour of the railway companies, at an average cost of about three shillings per mile.[139] Expenditure on railways increased from thirty-two per cent of total costs in 1854 to thirty-seven per cent in 1868, while

[136] The gross revenue of the Post Office dropped from £2,390,763 in 1839 to £1,359,466 in 1840 due to the introduction of the uniform penny post, while the net income decreased from £1,633,764 to £500,789. Gross revenue did not go back to pre-1840 levels before the 1850s, and the net income had to wait for the 1860s to exceed £1.5 million again. 'Sixth Report of the Postmaster-General on the Post Office', 1860.

[137] 'Report of the Select Committee on Postage', 14 August 1843. 30.

[138] Lewins, *Her Majesty's Mails*, 237.

[139] M. C. Reed, ed., *Railways in the Victorian Economy* (David & Charles Ltd., 1956), 93.

expenditures on mail-coaches dropped from twelve to nine per cent during that period.[140]

Hill's opponents won the first battle, and he was dismissed in July 1842. However, he returned in 1846 and was eventually appointed Secretary to the Post Office until 1864. Under his leadership, the number of post offices across the country increased steadily. There had been 4,028 post offices in 1840, which included head offices and sub-offices, and in 1858 that number had increased to 11,235.[141] By that time, the London District Post was fully integrated into the general post operation, and all the letters were now first sorted into the ten districts, and then re-sorted for the walks by each district's sorters, as their local knowledge made the sorting more efficient.[142] What is more, as Daunton pointed out, the following year about 93 per cent of all the letters handled by the Post Office were delivered free of additional charges.[143]

The first half of the nineteenth century had thus witnessed remarkable progress in the British postal system. While mail-trains, travelling post offices and automated mailbag exchanges accelerated the mail between towns, urban posts multiplied local offices and the number of deliveries – as frequent as hourly in the metropolis.

[140] The figures for 1854 were: £164,955 for the cost of conveyance by mail-coaches and £462,518 by railways, for a total expenditure of £1,433,830. 'Tenth Report of the Postmaster-General on the Post Office', 1864. 37. 'Fifteenth Report of the Postmaster-General on the Post Office', 1869.

[141] 'Fifth Report of the Postmaster-General on the Post Office', 1859. 7.

[142] The increased number of receptacles for letters also made the 'walks' more efficient. In 1863, there was a receptacle for every 327 houses in England and Wales, 261 for Scotland and 517 for Ireland. 'Twelfth Report of the Postmaster-General on the Post Office', 1866. 4.

[143] Martin Daunton, *Royal Mail: The Post Office since 1840* (London: The Athlone Press, 1985), 44.

Prepayment accelerated further the despatch of letters, and lower rates of postage ensured a broader public access to postal communication. Letters could now be received in a matter of hours, instead of days – not only for communications between London and the north of England or southern Scotland, but also in less populous places, such as the western coast of Wales: ‘a letter leaving London on Monday night’, reported the Postmaster General in 1865, ‘reached Aberystwyth at about 10am on Tuesday, and its reply, if posted before 4:30 p.m. the same day, reached London Wednesday morning’.[144]

There were, of course, some complaints and satirical comments in the press: ’In consequence of the extreme tardiness of the mails at home – caused by the apathy of the Post Office…’ began a drollery published by *Punch* in 1846.[145] But praises far exceeded them; in 1851, for instance, Dickens wrote:

> In so far as the perfection of materials for writing, and the facility of means for sending letters are concerned we have little more to hope for in this country.[146]

It is interesting to note that, in the same piece, Dickens praised the Post Office and its efficiency at handling letters, while at the same time looking at the march of science for ‘increased rapidity of transit’ and ‘increased frequency of communication’. He was of course referring to the electric telegraph, yet to be transformed from being a rare luxury into a commoditised service for the ‘correspondence of the million’.[147]

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[144] ‘Eleventh Report of the Postmaster-General on the Post Office’, 1865. 5.

[145] Anon, ‘The London Mails’, *Punch, or the London Charivari*, 1846.

[146] Charles Dickens, ‘The Birth and Parentage of Letters’, *Household Words* 79 (27 September 1851): 2.

[147] Ibid., 1.

2.4. Conclusion

The safe and fast conveyance of letters was the core mission of the Post Office from its inception, and the organisation demonstrated a quasi-obsession for constantly improving the speed and efficiency of its mail operation. Remarkable progress was achieved during the first half of the nineteenth century. Mail-coaches, which had supplanted messengers on horseback and stage-coaches, were replaced by mail-trains, while travelling post offices and other innovative solutions facilitated non-stop operation. As a result of these improvements, a letter sent from London to Bristol, a journey which had taken up to thirty hours by a messenger on horseback in the mid-eighteenth century, was taking just under four hours a century later. The development of urban or penny posts, especially the London District Post (later integrated in the General Post Office), increased at the same time the number of local post offices and the frequency of deliveries. In 1840, there were six mail deliveries per day in London, and this was later increased to an hourly delivery cycle. Within the metropolis area, a letter could be sent and delivered in just about two hours! Equally remarkable was the reform that took place in the 1840s: the prepayment by stamp which further accelerated the mail, the adoption of a distance-independent uniform postage rate to make letters affordable to the general public, and the increase in the number of post offices across the country to transform the Post Office into a truly ubiquitous communication service.

It is against this background that the electric telegraph was first introduced. In view of the Royal Mail's proven and efficient operation, many private telegraph companies looked upon it as a reference model. They replicated the organisation of the Post Office to a large extent, with telegraph stations replacing the post offices as collection points, electric wires supplanting the mail-trains for the conveyance of the messages, and messenger boys, like the letter-carriers of the Post Office, delivering the telegrams. LDTC went further, modelling itself after the London District Post. The prepayment of telegrams by stamp was widely adopted by the telegraph companies, and a modified version of the uniform postage rate concept was adopted by UKTC in an attempt to stimulate the take-up of its own service, just like the Post Office had done two decades earlier for the mail service. It is also worth noting that telegraph companies relied on the capillarity of the network of post offices across the kingdom when the recipient of a telegram was not within reach of a telegraph station: in this case, the telegram was simply directed to the poste restante of the nearest post office.[148]

In the next chapter, I show that Victorians perceived telegrams and letters as interchangeable – both forms of communication providing a similar epistolary service. From a user perspective, telegrams were not the communication revolution often touted in popular literature or early histories. The act of sending a telegram was similar to the act of sending a letter: the sender wrote the message on a piece of paper, before handing it to a clerk at a collection point for subsequent transmission. Upon reception, the message was then transcribed and delivered to the recipient by messenger, also just like a letter. Save for their laconic style, telegrams were essentially letters conveyed by a new technology. As pointed out in an article in the *British Quarterly Review* in 1867, 'telegraphic communication [is] simply quickened communication'.[149] To all intents and

[148] In an internal notice circulated on 22 October 1859, the Post Office asked that 'telegraphic messages forwarded to a post office be left till called for' and be treated as ordinary unpaid letters: M. M. Raguin, *British Post Office Notices 1666-1899* (Published by the author, 1991), 5 (1850–1859), p. 370.

[149] Anon, 'The Post Office and the Electric Telegraph', *The British Quarterly Review* 45, no. 89 (1867): 446.

purposes telegrams were letters, and this had repercussions during the debate about the nationalisation of the telegraphs.

Chapter 3. The rise of public telegraphy

Telegrams, Robert Albion wrote in 1932, revolutionised the world of communication.[150] Yet telegrams, like letters, simply conveyed written messages between individuals. In this chapter, I demonstrate that telegrams did not profoundly transform the way Victorians communicated with each other, and I contend that telegrams were not as disruptive as evoked by the revolution metaphor.

In exploring the early stage of development of public telegraphy under the private telegraph companies, I show that telegrams were not fundamentally different in operation to letters, nor were they significantly faster but for the most distant places.[151] Telegrams emulated and competed to some extent with letters – a situation, I argue, which contributed greatly to the nationalisation of the telegraph industry. To all intents and purposes, telegrams were letters, and indeed the two forms of communication were at times interchangeable, as illustrated below:

> CREMORNE BRANCH RESTAURANT, 1 New Coventry-street, Leicester-square … A telegram or letter to the Manager for dinners, public or private, will be attended to.[152]

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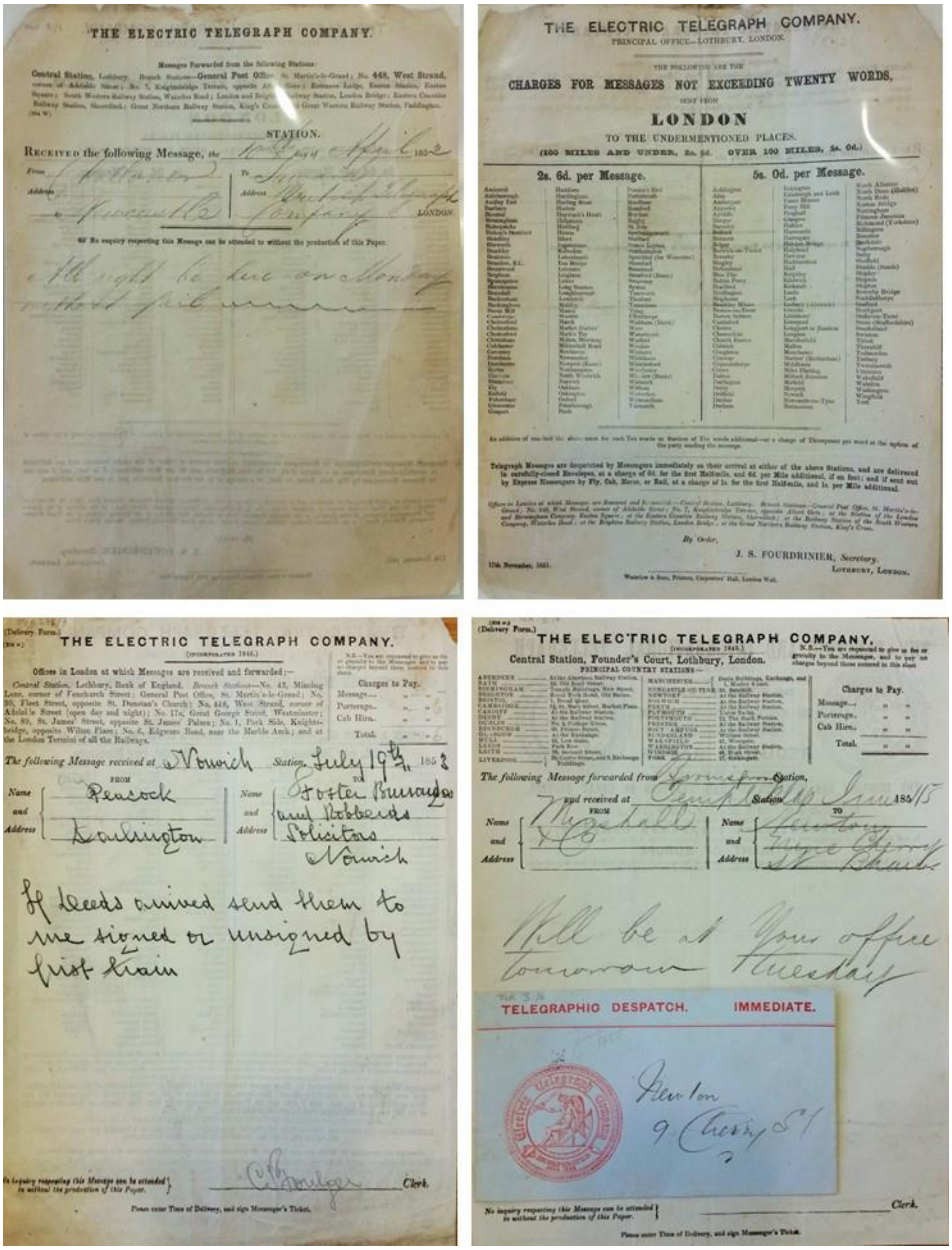
[150] Robert G. Albion, 'The "Communication Revolution"', *The American Historical Review* 37, no. 4 (1932): 718–20.

[151] David Edgerton wrote that 'technology has not generally been a revolutionary force; it has been responsible for keeping things the same as much as changing them', and I will show indeed that this was the case of telegrams in relation to letters. David Edgerton, *The Shock of the Old - Technology and Global History since 1900* (London: Profile Books, 2006), 212.

[152] This advertisement was published in *The Times* on 20 May 1864. Many other contemporary newspapers reveal the interchangeability of telegrams and letters: '…on looking over his file he saw a letter (a telegram) from Mr. Wood' (the *Morning Post*, 6 December 1859); '…a telegram or letter will ensure seats being reserved' (*The Times*, 8 December 1863); '…the Emancipation Society received a letter or telegram from Lord Brougham' (*Daily News*, 20 February 1863). It is interesting to note that such dual references appeared from 1859 and subsequent years, suggesting that the domestication of telegrams was not effective before that time.


THE ELECTRIC TELEGRAPH COMPANY.

THE ELECTRIC TELEGRAPH COMPANY.
PRINCIPAL OFFICE—LOTHBURY, LONDON.
CHARGES FOR MESSAGES NOT EXCEEDING TWENTY WORDS,
LONDON
TO THE UNDERMENTIONED PLACES.
2s. 6d. per Message.
5s. 0d. per Message.
J. S. FOURDRINIER, Secretary.

THE ELECTRIC TELEGRAPH COMPANY.
The following Message received at Norwich Station, July 19th, 1853
Peacock
Darlington
Foster Burroughs and Robberds Solicitors Norwich
If Deeds arrived send them to me signed or unsigned by first train

THE ELECTRIC TELEGRAPH COMPANY.
Central Station, Founder's Court, Lothbury, London.
Will be at Your office tomorrow Tuesday
TELEGRAPHIC DESPATCH. IMMEDIATE.

Figure 3.1. Early examples of telegrams. The one in the top left shows that ETC had nine London telegraph offices in 1852, including six in railway stations. The back of this telegram (top right) lists the 223 telegraph offices available in the country. By 1853 (bottom left photograph), the company had opened additional stations in London: eight stations, in addition to all the metropolis railway termini. The number of words for this telegram was twenty one (thirteen words for the text, and eight words for the sender and receiver addresses); an additional charge of 6d was levied for porterage in Norwich. Bottom right: the type of envelope used to deliver telegrams to recipients. The top of this telegram shows that in 1855 the company had twenty-nine principal telegraph offices across Britain.[153]

[153] 'Messages (Telegrams), 1852-1855' , TGA/3/1, BT Archives.

But if telegrams conveyed more continuity than change, why did they come into existence in the first place? Kieve believed that the stimulus for developing the electric telegraph arose when the 'need for some means of communication faster, not merely than the horse but than the train itself, became clear'.[154] Contrasting Kieve's opinion, I provide evidence which suggests that the electric telegraph was the result of a serendipitous meeting of inquisitive minds, scientific discoveries, and entrepreneurial flair – the approach was initially hesitant and opportunistic, and certainly not as clear a necessity as Kieve implied. Barton, for his part, believed that a need existed because the semaphore (optical) telegraph was in a declining phase.[155] In truth, the semaphore coexisted with the electric telegraph for many decades, sometimes in a symbiotic way, especially until the emergence of wireless telegraphy. In France, for instance, Chappe's optical telegraphs were used in conjunction with electric telegraphs to provide a maritime information service along the coastline.[156] In times of peace, this 'réseau électro-sémaphorique', as it was then called, offered a way to communicate with nearby ships for safety or commercial purpose – in effect, a ship-to-shore communication service that was connected to the continental telegraphic network.

The strategy eventually adopted by ETC, and by its competitors subsequently, was to market telegrams as a new means of communication to rival the mails, as noted by Dickens:

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[154] Kieve, *The Electric Telegraph*, 13.

[155] Barton, 'Construction of the Network Society', 36.

[156] Edouard-Ernest Blavier, *Nouveau Traité de Télégraphie Electrique*, vol. 2 (Paris: Eugene Lacroix, 1867), 371.

> The Post Office, industrious and effective as it is, will find an active rival standing by its side – bidding against it for popularity, coming in to share its message-carrying trade.[157]

Indeed, by the early 1860s telegraph companies were referred to by the press as 'public institutions of necessity' – testament to the successful commodification of telegrams as a mail substitute.[158] But this success came with a heavy price to pay: customers expected telegrams to be as convenient as letters. As a result, the public became increasingly critical of the lack of telegraph offices (in relation to the number of post offices), their poor locations (all too often on the outskirts of towns, unlike centrally located post offices) and the high cost of telegrams (in relation to cheaper postage).[159] Such a negative perception on the part of the public strengthened the lobby calling for the appropriation of the private telegraph companies by the General Post Office.

This chapter is made up of four sections. In the first section ('**an event of significance')**, I explore a pivotal incident – one which has been underestimated in past accounts: in 1840, a patent dispute broke out between Cooke and Wheatstone, which led to the breakdown of their partnership. The outcome of this dispute was a negotiated settlement which shaped British telegraphy for the next twenty years: firstly, it enabled the formation of ETC and stimulated (if not instigated) the first foray into public telegraphy; secondly, it stifled an innovation, creating a dominant technology (the needle technology favoured by Cooke) by eliminating its main rival (the step-by-step dial

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[157] Charles Dickens, 'House-Top Telegraphs', *All The Year Round* 2, no. 31 (26 November 1859): 108.

[158] Anon, 'Private Telegraphy', 2. See also Chapter 4's epigraph.

[159] At its peak, in 1868, the number of telegraph offices (before nationalisation) was slightly more than 3,300 with almost 2,000 in railway stations, of which nearly 800 were used exclusively for railway operation. By contrast, the Post Office had already exceeded 10,000 offices as early as 1855, and all these were located conveniently within the towns. Kieve, *The Electric Telegraph*, 73. 'Second Report of the Postmaster-General on the Post Office', 1856. 7.

technology designed by Wheatstone) – thus stopping a promising development path for the electric telegraph. In analysing the feud between these two men and their chosen technologies, I reveal that pride and reputation prevailed over technical factors in the selection of the needle technology. As will be seen in Chapter 4, however, the dial technology re-emerged in the late 1850s because of its greater usability and superior ergonomics.

In the second section (‘**the public telegraph’**), I explore the rise of public telegraphy in Britain. This history of the electric telegraph has already been written, and I draw upon Kieve’s and Barton’s comprehensive works on the subject. My narrative, however, is particularly concerned with an aspect of the Victorian telegraph that has only been superficially addressed in these scholarly works: the operational model adopted by the private telegraph companies. My aim is to establish parallels between public telegraphy and postal services, to make (ultimately) the contrast between public and private telegraphy even starker – a central tenet in the discourse about the duality of the telegraph. It is this new perspective that makes this particular unit of research original. The turning point for public telegraphy was the formation of ETC and I concentrate my analysis on this company as it became a normative model for others to follow. The number of miles of telegraphic lines laid down by this company over the years, its wayleave arrangements with the railways and the politics behind its corporate governance, have been well documented in previously mentioned studies. This analysis, however, focuses on the organisation of the collection points and the mechanisms for delivering telegrams, as these were vital for establishing a service for the public. During the course of this investigation, I also draw attention to UKTC, which not only attempted to implement a uniform rate irrespective of distance reminiscent of Rowland Hill’s postal reform of 1840, but was also the first telegraph company to propose a generic private telegraphy service, although it was never implemented.

The third section (‘**dear telegraph’**) is a synchronic perspective of telegrams and letters in the 1860s, prior to the nationalisation of the telegraph. It is a comparison between the two modes of communication, their availability and convenience, speed of delivery and cost. In this analysis, I show that, despite the efficiency of the postal system, telegrams were faster than letters for inter-urban communication – although the speed advantage was not as great as the revolution metaphor suggests. Moreover, evidence suggests that their usage was limited to professionals and the well-to-do classes of Victorian society due to their high cost, whereas letters were used by a much broader spectrum of society. Crucially, I draw attention to the relatively small number of telegraph offices in relation to the number of post offices during this period, and especially their absence in smaller towns and rural areas. This deficiency, however, was to a certain degree mitigated by the possibility of posting telegrams for the final leg of their journey – an aspect of public telegraphy that highlighted the interchangeability of telegrams and letters. Finally, I establish that letters were more efficient than telegrams for intra-urban communication, and much cheaper too. As we shall see in the next chapter, this situation will explain to a large extent the proliferation of private telegraphy in cities.

In section four (‘**the politics of appropriation’**), I deal with the politics of public telegraphy. Here, I reveal that calls for the intervention of the state and for the taking over of the telegraphs by the Post Office took place as early as 1852. Most importantly, I argue that the commonality of purpose and the rivalry between telegrams and letters influenced the debate on the nationalisation of the telegraph industry – a factor which has been overlooked in the historical literature. Much has been written about this first ever nationalisation in British history, the root of which has been attributed to a range of factors, including the monopolistic behaviour of the telegraph companies, public dissatisfaction, ideological considerations and the growth of government during the nineteenth century. To introduce this discussion, a brief summary of the nationalisation process is provided. I then demonstrate that the functional overlap between telegraphic and postal services was yet another, and possibly the most important factor. Would the nationalisation have taken place had public telegraphy not competed with postal services? In answering this question, I suggest two counterfactual scenarios using a 'path not taken' approach in which the private companies provide telegraphic communication services that did not compete with letters, or were sufficiently differentiated to not be considered a direct rival to the Royal Mail.[160] Counterfactuals, to borrow Radick's words, 'do not necessarily inhabit an evidence-free zone'. Indeed, the private wires – one of the alternatives described in the scenarios – were actually considered by the Post Office and excluded from the nationalisation initially, providing further evidence that the rivalry between telegrams and letters was a major causal factor behind the nationalisation.[161]

3.1. An event of significance

The partnership between Cooke and Wheatstone was a key determinant in the development of telegraphy in Britain. Yet, this partnership lasted for a relatively short

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[160] In his exploration of counterfactuals, Brown describes the 'path not taken' approach as an insight ultimately normative. John Brown K., 'Not the Eads Bridge: An Exploration of Counterfactual History of Technology', *Technology and Culture - The International Quarterly of the Society for the History of Technology* 55, no. 3 (July 2014): 524.

[161] Gregory Radick, 'Why What If?', *Isis* 99, no. 3 (September 2008): 549.

period of time, from 1837 to 1840. An acrimonious dispute between the two men erupted as a result of an intellectual ownership conflict with regard to their second joint patent of 1840. Despite an attempt at resolving the issue in 1841, the conflict persisted and soured their relationship, even though they remained in contact by business necessity, if not by friendship, until Wheatstone's death in Paris on 19 October 1875. Cooke became eventually the sole proprietor of the joint patents, allowing him to enter into a business relationship with ETC, free of interference from Wheatstone; and this led to the development of public telegraphy.

Kieve has missed some important details of this episode. Attributing the victory to Cooke, even though he qualified it as an 'ambiguous award', was an oversimplification.[162] The step-by-step technology was the key element of the joint patent of 1840.[163] In this analysis, I provide evidence that this invention by Wheatstone – and him alone – was at the centre of this dispute, and that his intellectual ownership of this technology gave him the upper hand in the ensuing negotiation between the two parties, despite all appearances to the contrary.[164] At the origin of the dispute was the needle instrument designed and favoured by Cooke, which benefited from the science behind the technology developed by Wheatstone. This situation compelled Cooke to take control of the entire patent. In achieving his aim, though, Cooke blocked further

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[162] Kieve, *The Electric Telegraph*, 41.

[163] See Appendix 4 for a description of the step-by-step technology.

[164] The analysis makes extensive use of two documents which were produced separately by Cooke and Wheatstone in the 1850s, and written in the context of the arbitration proceedings resulting from the dispute and its aftermath. These nearly 400 pages of claims and counterclaims make for a difficult reading, but they are a major source of information about the early days of telegraphy and about this event in particular.

technical development of the step-by-step technology – a technology at the heart of private telegraphy, as we shall see in Chapter 4. To begin, an examination of events in the year 1840 is necessary.

> Professor Wheatstone, the inventor of the electrical telegraph which is now at work on the Great Western Railway, is at present in Brussels, where he has been trying the new improvements he has introduced in his apparatus. Mr Wheatstone has succeeded in so simplifying his apparatus that he has reduced the number of wires employed to two.[165]

In that year, the GWR telegraph project was beginning to bear fruits. As can be seen in *The Times* quotation above, the press did not recognise Cooke's contribution towards the invention of the electric telegraph, giving instead all the credit for this innovation to Wheatstone. It is possible that for being a professor of experimental philosophy at King's College London and a Fellow of the Royal Society since 1836, Wheatstone was seen as a trustworthy public figure and the newspaper may have singled him out to make the story more appealing to readers. Nonetheless, similar misrepresentations had occurred before. A few months earlier, for instance, Wheatstone had been questioned on the subject during a session of the Select Committee on Railway Communication. The report shows that Cooke's contribution was somewhat acknowledged (although Cooke commented with some resentment that he was waiting at the door of the committee room but was never called in for questioning), it was Wheatstone and 'his inventions' that took centre stage in the committee's report.[166] To the judgemental Cooke, this was unacceptable.

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[165] 'Professor Wheatstone', *The Times*, 16 October 1840.

[166] 'Mr Wheatstone, professor of experimental philosophy at King's College, has for some years turned his attention to this subject, and has, in conjunction with Mr Cooke, obtained patents for his inventions'. 'Fourth Report from the Select Committee on Railway Communication', *Morning Chronicle*, 9 July 1840, 1. Cooke, *The Electric Telegraph: Was It Invented by Professor Wheatstone?*, Part 1-Pamphlets of 1854-6.:37.

Wheatstone's public statements, Cooke believed, were delivered in a disingenuous manner by intentionally omitting his contribution to the electric telegraph. To the unobservant reader, the article in *The Times* might indicate that such was the case, but on closer inspection it is clear that reference is made to their second joint patent which had been granted in January 1840 and is sometimes referred to as the third English specification. This specification described two instruments: an evolution of Cooke's mechanical telegraph and Wheatstone's new 'escapement' telegraph.[167] Cooke's instrument differed fundamentally from Wheatstone's in that the transmitter used a simple two-way switch to send signals. Wheatstone's device, on the other hand, later served as the prototype for the future ABC (dial) instrument, so recognisable by its capstan carrying the letters of the alphabet on its circumference.[168]

Wheatstone described this invention as his own, but Cooke believed that the joint patent, with his name, displayed by mutual agreement, prominently before that of Wheatstone gave him equal rights. Writing in 1854 about his recollection of the events, Cooke said:

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[167] Cooke's 1838 patent (the second specification) followed on Cooke and Wheatstone 1837 joint patent (the first specification). The 1838 patent was mostly about the operation of the intermediate instrument that would be specifically identified in 1840 in the third sheet of drawings of the 1840 patent (which will be examined later in this chapter), but amongst other improvements, there was also an electro-magnetic mechanism that disengaged the stop detent of the alarm, a mechanism used in Cooke's original mechanical telegraph in 1836. Cooke described, *a posteriori*, some features of the mechanical telegraph, and he tentatively filed a patent in 1836, but the specification of this patent was never enrolled. William Fothergill Cooke, A.D. 1836, No. 7174 [Improvements in winding-up springs to produce continuous motion, applicable to various purpose], 7174 (England & Wales, issued 17 August 1836). William Fothergill Cooke, A.D. 1838, No. 7614 [Improvements in giving signals and sounding alarums at distant places by means of electric currents transmitted through metallic circuits], 7614 (England & Wales, issued 18 April 1838). Cooke, *The Electric Telegraph: Was It Invented by Professor Wheatstone?*, Part 1-Pamphlets of 1854-6.:29.

[168] The dial instrument is discussed in Chapter 4, and further described in Appendix 4.

> I soon found that Mr. Wheatstone was silently appropriating to himself the whole credit of the invention; and as early as August 1838, I addressed to him an earnest remonstrance on this subject. His promises to do me justice led to no result; and in 1840 the evil was aggravated by his invention of a beautiful and promising form of the mechanical telegraph, which he put forward at home and abroad as his sole invention, although only an improved reproduction of my own mechanical arrangements.[169]

Wheatstone rejected these accusations in a letter addressed to Cooke on 26 October 1840 – a letter in which, in a rare display of bitterness on his part, he reminded Cooke that, firstly, he never had the intention to 'give up [his] right to call [his] own discoveries and inventions [his] own', and secondly, that Cooke's instruments were tentative prototypes, while Wheatstone's instruments had demonstrated their practicality from the very beginning.

> Firstly, you state that 'you alone had succeeded in reducing to practical usefulness the Electric Telegraph at the time you sought my assistance.' Now this I wholly deny; it is utterly at variance with the facts. Your instrument, however ingenious in its mechanical arrangements, had never been practically applied, and was incapable of being so. On the contrary, the instruments I had proposed were all founded on principles, which I had previously proved by decisive experiments would produce the required effects at great distances.[170]

Indeed, Wheatstone had a deep knowledge of Ohm's Law and of the significance of electrical resistance in long metallic wires.[171] Moreover, he had also made a critical and valuable contribution to Cooke's mechanical arrangements – acknowledged by Cooke – in the shape of the vertical needle technology. Yet, Cooke thought that the issue raised by Wheatstone about the patent of 1840 (which Cooke himself referred to as a 'beautiful and promising' telegraph) was 'judiciously thrown in to distract the attention

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[169] Cooke, *The Electric Telegraph: Was It Invented by Professor Wheatstone?*, Part 1-Pamphlets of 1854-6.:viii.

[170] Charles Wheatstone, *A Reply to Mr Cooke's Pamphlet 'The Electric Telegraph, Was It Invented by Professor Wheatstone?'* (London: Richard Tailor and William Francis, 1855), 65.

[171] See Appendix 1 for a summary of Wheatstone's scientific contributions to the fields of acoustics, optics and electricity.

from the questions really at issue'.[172] While accepting that this telegraph was invented by Wheatstone, he upheld that the step-by-step technology was an improved version of his own (mechanical) instrument. It may have been a negotiating posture, or perhaps he had forgotten that his own mechanical arrangements were never practical, and might never have been operational without the scientific insight of Wheatstone, as evidenced by a letter he wrote to his mother on 27 February 1837 in which he acknowledged that Wheatstone was 'the only man near the mark' as he had already four miles of wires 'in readiness' together with 'two or three' telegraphs. [173]

Cooke's accusation does not appear to have had any financial motive. They had, after all, already agreed to joint ownership of the patent. However unfounded it may have been, this allegation is likely to have had another purpose. From their study of disputes about patent rights from the 1870s to the 1920s, Arapostathis and Gooday found that some inventors were as much concerned about reputation and social standing, as with intellectual ownership.[174] This may also have been the case here, even though it happened in an earlier period and patent infringement was clearly not the issue. Indeed, as Marsden and Smith pointed out, such men 'were adept in fashioning images of themselves'.[175] Perhaps then, Cooke was making such a claim to seek a status

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[172] Cooke, *The Electric Telegraph: Was It Invented by Professor Wheatstone?*, Part 1-Pamphlets of 1854-6.:273.

[173] 'Cooke's Acknowledgement of Wheatstone's Telegraphic Expertise' 27 February 1837, SC MSS 7 (Box 1), IET.

[174] Stathis Arapostathis and Graeme Gooday, *Patently Contestable* (Cambridge, Mass.: The MIT Press, 2013).

[175] Marsden and Smith, *Engineering Empires - A Cultural History of Technology in Nineteenth-Century Britain*, 242.

equal to that of Wheatstone. This would certainly explain why Cooke was intent on pursuing this matter through an arbitration procedure.

To resolve the impasse, the two parties agreed to defer to an arbitration panel. On 16 November 1840, a deed of reference was drawn up so 'that the relative positions of the said parties should be ascertained by arbitration'.[176] It took five months for the arbitrators to come up with a mutual agreement on the matter. The arbitrator chosen by Cooke was Sir Marc Isambard Brunel, FRS.[177] Wheatstone, for his part, nominated Professor Daniell, a colleague from King's College and perhaps best known for his invention of an efficient galvanic battery after his name, the Daniell Cell. On 27 April, 1841, Brunel and Daniell made their famous award, with the last paragraph revealing that:

> Whilst Mr. Cooke is entitled to stand alone, as the gentleman to whom this country is indebted for having practically introduced and carried out the Electric Telegraph as a useful undertaking, promising to be a work of national importance; and Professor Wheatstone is acknowledged as the scientific man, whose profound and successful researches had already prepared the public to receive it as a project capable of practical application; it is to the united labours of two gentlemen so well qualified for mutual assistance, that we must attribute the rapid progress which this important invention has made during the five years since they have been associated.[178]

By accepting the wording of this statement, Wheatstone gave Cooke, at least on the face of it, precedence over the invention. Apparently, Wheatstone was satisfied for being given the role of the 'man of science' behind the endeavour. Brian Bowers, the author of a comprehensive biography of Wheatstone, believed that this is what

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[176] Cooke, *The Electric Telegraph: Was It Invented by Professor Wheatstone?*, Part 1-Pamphlets of 1854-6.:38.

[177] Marc Isambard Brunel was a French-born engineer, builder of the Thames Tunnel and father of Isambard Kingdom Brunel, FRS, perhaps best known as chief engineer for the Great Western Railway.

[178] Cooke, *The Electric Telegraph: Was It Invented by Professor Wheatstone?*, Part 1-Pamphlets of 1854-6.:16.

Wheatstone wanted and his acquiescence can be explained by his wish to 'continue his researches in peace'.[179] However, on the basis of what happened next, it appears more likely that the wording did not reflect the spirit of the agreement and was subject to interpretation, because when Cooke's solicitor, Mr Robert Wilson, wrote a letter on 5 May 1843 asserting that on the basis of this award 'Mr. Cooke was in the right, and Mr. Wheatstone in the wrong', Wheatstone immediately asked Daniell for his thought on the matter.[180] Daniell's response on 24 May 1843 is extraordinary as it implies that Wheatstone had not been deeply implicated in the arbitration proceedings and had relied on his colleague and friend to defend his interests. In the first instance, Daniell reminded Wheatstone that the same Wilson had, prior to the settlement, threatened to publicly distribute 1,000 printed copies of an *ex-parte* statement as a way of exerting pressure on the arbitration process.[181] He then stated that, due to time and budgetary considerations, the arbitration did not result in an award but in a 'statement of fact'.[182] However, he also confirmed what Wheatstone had intuited all along, that this was not a statement about the originality of the inventions on either side, but about the commercial positioning of the parties, for Wheatstone had agreed that Cooke was 'entitled to stand alone, with the assent of the arbitrators, for conceiving, and energetically following up his conception, that the Electric Telegraph might be made a

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[179] Bowers, *Sir Charles Wheatstone FRS 1802-1875*, 147.

[180] Wheatstone, *A Reply to Mr Cooke's Pamphlet 'The Electric Telegraph, Was It Invented by Professor Wheatstone?'*, 31.

[181] The 1,000 printing copies were eventually destroyed as a prerequisite to the award.

[182] Geoffrey Hubbard made the valid point that the task of analysing minutely hundreds of pages of arguments and counterarguments was likely to be a challenge for an elderly civil engineer and a chemist – a possible explanation for their proposal for an 'award which did not settle anything'. Hubbard, *Cooke and Wheatstone and the Invention of the Electric Telegraph*, 95.

profitable commercial enterprise, and for his having carried out an undertaking of such great importance to the public'.[183] Thus, as a result of the lack of clarity of the arbitration's result, the 'statement of fact' could be interpreted in different ways.

Fortunately for Wheatstone, the two parties had also agreed on a separate, less known agreement, considered by Wheatstone as the substance of the award. It specified his 'separate privileges' which included:

> The right of putting before the public, as his own, the inventions described on the 1st, 2nd and 4th drawings of the specification of the patent of 1840.[184]

The footnote associated with this statement is also quite instructive as it tells of Cooke's failed attempt at rescinding such privileges, by proposing that both names appeared on all the patented instruments, and offering a compensation of £1,000 out of the future proceeds. What is even more surprising is that this latest squabble came just weeks after an agreement had been concluded between them, on 12 April 1843, in which Wheatstone's share of the joint patents was assigned to Cooke in exchange for royalty payments calculated on a pro rata of the length of telegraph lines completed (referred to as 'mileages'), as reported every January and July of each year.[185] The royalty payments, which were to cease with the expiration of existing patents,

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[183] Wheatstone, *A Reply to Mr Cooke's Pamphlet 'The Electric Telegraph, Was It Invented by Professor Wheatstone?'*, 30.

[184] The first, second and fourth sheets of drawings annexed to the specification were to remain Wheatstone's inventions, and he had exclusive use of such inventions in 'private-houses, manufactories and public establishments, whether they be applied within the buildings, or to connect lodges, out-houses, &c. with the main buildings or with each other', with the provision of telegraphic services in docks, harbours, fortifications, and railway termini remaining governed by the conditions set forth in the previous arrangement. Ibid., 19–20, 28.

[185] Cooke, *The Electric Telegraph: Was It Invented by Professor Wheatstone?*, Part 1-Pamphlets of 1854-6.:7, 42.

decreased for every 10 miles of lines completed during the year, from £20 per mile for the first 10 miles, to £15 per mile beyond 50 miles. Wheatstone remained also entitled to the use of existing and future patents which had not expired at the termination of this agreement, while being allowed to build and operate, free of royalty and for his own separate benefit, such patented devices on telegraph lines not exceeding half a mile in distance.[186]

During the next two years, Cooke pursued his efforts to demonstrate the practicality of the electric telegraph. As we shall see in the next section, he also brought together a group of investors who backed the formation of ETC. However, one final round of negotiation between Cooke and Wheatstone was to take place before this could happen, as the investors had expressed some reserves about the amount of royalties granted to Wheatstone in 1843 for future telegraph lines. The result of this negotiation was a new agreement, signed in 1845, and in which Wheatstone sold to Cooke his remaining rights to the patents and relinquished royalties on telegraph lines in exchange for a lump-sum payment of £30,000.[187] Wheatstone's interest in telegraphy seems to have waned from this date, and Cooke pursued on his own the business of public telegraphy, as we shall see next.

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[186] Ibid., Part 1-Pamphlets of 1854-6.:94. Dawson also pointed out that, while restricting Wheatstone's exploitation of the step-by-step technology in Britain, this agreement allowed him free foreign promotion, which had a far reaching effect in Europe and especially in France where engineers like Louis Breguet and Paul-Gustave Froment emulated and improved the concept. Dawson, 'The Early History of Electro-Magnetic Telegraph Instruments', 417.

[187] A letter from Wheatstone, dated 2 August 1845, describes the terms of the new agreement, whereby he was willing to commute his rights to royalties for the sum of £30,000: £20,000 for all lines in England and wales, and £10,000 for his rights in Scotland, Ireland and Belgium. Cooke, *The Electric Telegraph: Was It Invented by Professor Wheatstone?*, Part 1-Pamphlets of 1854-6.:243.

3.2. The public turn

The £30,000 represented a significant amount of money which Cooke did not possess at the time, as he was already 'out of pocket on the operations of the ten preceding years'.[188] However, Cooke was not alone in this venture. He had the support of two entrepreneurs with whom he was negotiating the sale of the patents to the yet-to-be incorporated ETC, and the proceeds from this sale would eventually provide him with the necessary funds to conclude the agreement with Wheatstone.[189] The entrepreneurs were John Lewis Ricardo, MP for Stoke and nephew of the economist David Ricardo, and George Parker Bidder, a prominent railway engineer and an associate of Robert Stephenson, the son of George Stephenson who had built the Stockton & Darlington Railway mentioned in the previous chapter.

This complex set of parallel transactions reveals Cooke's remarkable business acumen. It involved no fewer than six indentures between November and December 1845, and a last one in August 1846 to finalise the arrangement: the establishment of a co-partnership between Cooke, Bidder and Ricardo – and the formation of a joint stock company called the Electric Telegraph Company.[190] In the first instance, Wheatstone agreed to surrender to Cooke his outstanding rights in the English, Irish and Scottish patents. He also agreed to release all claims of royalties on present and future

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[188] Ibid., Part 1-Pamphlets of 1854-6.:233.

[189] ETC was first advertised in *The Times* on 3 September 1845, although the company was not formally established until the private act: 'An Act for Forming and Regulating the Electric Telegraph Company', 18 June 1846, 9 & 10 Vic. Cap. 44.

[190] The indentures were dated 28 and 29 November 1845; 2, 3, 12 and 23 December 1845; and 5 August 1846: 'Indentures (in Folder: Indentures between William Fothergill Cooke, George Parker Bidder and John Lewis Ricardo, 1845)', TCB 588/11, BT Archives. Also in: Cooke's Papers, SC MSS 007 Volume 4 in IET Archives.

'mileages'. This was followed by an agreement between Ricardo, Bidder and Cooke about the distribution and transfer of shares in the patents. The value of all the patents had been established at £160,000 and divided into thirty two equal parts (or shares). Ricardo was assigned twelve parts (£60,000), Bidder received eleven parts (£55,000) and the remaining nine parts remained with Cooke (£45,000) as his share of the new company. As part of the deal, in addition to becoming one of its directors, Cooke also transferred to the company his rights to the South Western, Great Western and ten other railway companies, as well as his pending agreements with six other railways and the Admiralty.

In addition to receiving £30,000, Wheatstone was offered the role of scientific advisor with a salary of £700 per year.[191] However, he resigned almost immediately from this position to express his opposition to the proposal to nominate Alexander Bain as a director of the company.[192] Bain, a clock maker and telegraph inventor, had filed a petition opposing the private bill on the ground that the patents (by then under ETC's ownership) infringed on his own invention, and the proposal to appoint him as a director of the company was intended to forestall his threat to sue the company.

Ricardo (its first chairman), Bidder and Cooke were thus at the helm of ETC, although Bidder did not officially become a director of the company until 1852. Barton postulated that Robert Stephenson was a secret shareholder of ETC – the secrecy being

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[191] Cooke, *The Electric Telegraph: Was It Invented by Professor Wheatstone?*, p. 249, 270.

[192] Alexander Bain was a Scottish engineer, most famous for his invention of an electric clock and a chemical telegraph. Bain claimed that Wheatstone had stolen some of his ideas. See Appendix 4, footnote 613. This episode is also referred in Cooke's pamphlet (Part 1) on page 255, and *The Times* on 6 June 1846 and 30 April 1853.

required as his involvement in a company that sold telegraphic traffic solutions to rival railway engineers created a conflict of interest.[193] Eventually, in 1856, Stephenson also became a director of the company.[194] The participation of Bidder and Stephenson (and possibly other railway engineers as secret shareholders) in the development of the company at this early stage seems to have been the result of a conjuncture of Cooke's persistent lobbying of the railway industry since 1837 and the growth of the speculative bubble known as railway mania, which peaked circa 1846.[195] The electric telegraph, Cooke had said in 1842, was to be 'a new system of railway communication, at once safe, economical and efficient' – a vision endorsed by the railway engineers who embarked on this entrepreneurial venture.[196] The electric telegraph was believed to be

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[193] Barton believes that there may have been up to twenty three shareholders, many of whom were not listed as their holdings (including the one from Stephenson) were held in trust by Bidder. There was, according to Barton, the issue of the potential conflict of interest, and the possible invalidation of the patents, had it been known that they were owned by more than twelve people: Barton, p. 72. It should be noted however, that even before the Patent Law Amendment Act 1852 (15 & 16 Vic. Cap. 83) which permitted more than twelve persons to have an interest in letters patent, there had been previously several instances of private acts that authorised the transfer to more than twelve persons – for example, an Act in 1840 which granted such authorisation to the Marquess of Tweeddale related to his manufacture of drain-tiles and bricks. Hansard: 'An Act to Authorize the Transfer to More than Twelve Persons of Certain Patents Granted to the Marquess of Tweeddale' (HC Deb Vol 55, 11 August 1840). See also: Thomas Webster, *The New Patent Law: Its History, Objects and Provisions.* (London: F. Elsworth, 1853), 39.

[194] 'ETC Half Yearly Records 1851-1872', TGA/2/1, BT Archives.

[195] Cooke's lobby started in January 1837 when he first contacted the directors of the Liverpool and Manchester Railway Company. Although this proposal was unsuccessful, it was followed that same year by the experiment at the London and Birmingham Railway Company (Euston Station to Camden Town) where Robert Stephenson first became involved with the electric telegraph, and in 1838 by the experimental line for the Great Western Railway Company which started operation in July 1839, an experiment from which Cooke developed the 'block system' concept.

[196] William Fothergill Cooke, *Telegraphic Railways, or the Single Way Recommended by Safety, Economy and Efficiency under the Safeguard and Control of the Electric Telegraph* (London: Simpkin, Marshall & Co., 1842), 34.

the answer to growing safety concerns with regard to railway traffic management, especially for single lines.

The first commercial use of the electric telegraph was therefore a private telegraphy application that employed needle instruments: a railway communication system that improved operational safety and efficiency. GWR was the first railway company to adopt such a system in 1844, and many others followed suit, although almost reluctantly at first because the bursting of the speculative bubble in the second half of the decade had reduced their appetite for risky investments when the value of their shares collapsed.

The newspapers had published articles about the electric telegraph since the late 1830s, and in 1845 the public was apparently sufficiently fascinated by this innovation to pay one shilling to visit the telegraph office in Paddington station to see the 'Wonder of the Age' in operation.[197] Perhaps, this was the result of the telegraphic transmission of high profile news such as the announcement of the birth of Prince Alfred in August 1844 or the arrest of the murderer John Tawell in January 1845, news which was also widely publicised as having been transmitted by telegraphic means.[198] Yet, in these early days of telegraphy the public made little use of such communication facilities, due to the limited availability of the service, its high cost, and the telegraph offices all too often inconveniently located in 'all the chief railway locations, on all the chief lines, with one

[197] 'Wonder of the Age' is an early advertisement for the electric telegraph dating from 1845. A copy of this advertisement can be seen in BT Archives (negative reference E.51905).

[198] 'Birth of a Prince', *The Times*, 7 August 1844, 5. 'Suspected Murder at Salt-Hill', *The Times*, 3 January 1845, 7.

or two exceptions'.[199] As pointed out by contemporary observers during this period, telegraphic messages were uncommon, and related to 'matters of business'.[200] By this time, however, the company had moved its London Central Office from the Strand to Lothbury in the City (opposite the Bank of England), where telegraphic wires extended to all the main metropolitan railway termini, and from there to all the principal towns wherever a railway existed. It is at that point that the business started in earnest: on 30 June 1851 the revenue reported from 'messages, subscriptions and maintenance' amounted to £27,437, and by the end of that year 2,122 miles of lines had been laid down and 99,216 messages transmitted.[201]

It was not until the mid-1850s, though, that the use of telegraphic messages became more prevalent in the professional sphere, and began its slow inroad into the domestic sphere.[202] Professional users of telegraphy included initially the railways, the Admiralty, the media and the financial institutions.[203] As pointed out by Kieve and

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[199] Dickens, 'Wings of Wire', 242. During the nationalisation debate it was also noted that telegraph offices located in or near the railway stations were frequently three-quarters of a mile or a mile from the town itself. Hansard: 'Electric Telegraph Bill' (HL Deb Vol. 193, 24 July 1868).

[200] Anon, 'The Electric Telegraph', in *Curiosities of Communication* (London: Charles Knight, 1851), 33. It is worth noting that the earliest preserved telegraphic message in the BT Archives is dated 8 August 1850: although it could simply be a question of preservation, it may also attest to the rarity of telegrams before 1850.

[201] 'The Electric Telegraph Company Half Year Reports (1851-1872)', TGA/2/1, BT Archives.

[202] Advertisements appeared in newspapers in early 1852 through which ETC called the attention of the public to 'the facilities now afforded [by the company] for the transmission of messages to correspondents and friends in England and Scotland': 'The Electric Telegraph Company', *The Times*, 17 January 1852, 9.

[203] The electric telegraph on the South-Western Railway carried the traffic between the Admiralty and the naval establishment at Portsmouth, in addition to 'usual functions for the railway', and there was a plan to open to the public this means of communication at the office of the railway company: 'The Electric Telegraph on the South-Western Railway', *Hampshire Advertiser & Salisbury Guardian*, 15 March 1845, 1.

Barton, newspapers had realised the value of telegraphic despatches for feeding stories to newspapers as early as 1845.[204] Ricardo seems to have thought at the time that the distribution of telegraphic news to a wider audience was feasible and potentially a profitable business, for in 1846 he created an intelligence department, distinct from the private message department, with the objective of selling subscriptions to telegraphic news compiled from London daily papers and other sources. These were still the days of the 'slovenly scissors and paste weekly [provincial] journal' that was a 'mere stale jumble of the week's news patched together without method or originality' wrote Wynter in 1861.[205] Indeed, provincial newspapers were not produced and published daily until after the abolition of the 'taxes on knowledge' in 1861.[206] In the meantime, the London morning newspapers were despatched daily across the country by Messrs W.H. Smith by early trains or fast coaches, and were not available until later in the day: from 1:45 p.m. in Manchester and 8:45 p.m. in Edinburgh. The electric telegraph satisfied the need for an even faster despatch of news, especially in the business community. The

[204] The story of a public meeting in Portsmouth, which had taken place 'that evening', was despatched via the telegraph line established between London and Portsmouth. The entire duration of the transmission had taken half an hour: 'Portsmouth Lines', *Standard*, 8 May 1845, 1. See also: Kieve, *The Electric Telegraph*, 40. Barton, 'Construction of the Network Society', 67. It should be noted that Cooke demonstrated earlier the 'usefulness' of telegraphic despatches to the press by transmitting the Queen's speech (about 3,500 characters) from London to Gosport in less than two hours: 'Gosport Telegraph Station', *Morning Chronicle*, 5 February 1845, 7.

[205] Andrew Wynter, 'Our Modern Mercury', *Once a Week - An Illustrated Miscellany of Literature, Art, Science, & Popular Information* 4 (2 February 1861): 160. Wynter was a physician and a frequent contributor of articles in journals and magazines of the day, especially on the topic of the telegraph.

[206] Francis Bond, *Stokers and Pokers, or the London and North Western Railway - The Electric Telegraph and the Railway Clearing House* (London: John Murray, 1861), 119. The abolishment of the tax on advertisement in 1853 was followed by the abolishment of paper duty in 1861 (the stamp duty, however, remained for postal purposes).

intelligence reports provided by the company included news of commercial or public interest, such as the prices of shares, the weather in different parts of the United Kingdom, shipping arrivals and departures, losses and disasters at sea, general news of the day and Parliamentary news during the sessions. No list of subscribers has apparently survived the years, but it is highly likely that the vast majority of newsrooms and exchanges across the country subscribed to such intelligence reports, as members of these public subscription-rooms, which included professionals such as merchants, bankers, brokers and dealers, could benefit from the latest news at almost the same time as their London counterparts.[207] ETC also established its own telegraphic newsrooms in all its main offices across the country, in which intelligence gathered in London was posted as early as eight o'clock in the morning. But these were not as successful as Ricardo had hoped for and they were eventually closed down. However, the company continued to distribute news to third parties as part of its intelligence business. This part of the business, however, was never critical: in 1855, the receipts from 'intelligence contracts' represented less than ten per cent of the company's turnover, far behind the revenues generated by the messaging business (seventy seven per cent) and the maintenance contracts (fifteen per cent). The steady growth of the messaging business was underpinned by the growth of the network and by an increasing presence in towns and cities across the country. The form printed in 1855 (see Figure

[207] The perceived value of such reports can be established from anecdotal evidence: in one instance, for example, Mr Wrigley, the master of the Manchester Exchange newsroom, was expelled from the membership of the telegraph subscription newsroom for having pirated the intelligence for his benefit: 'Manchester Exchange Newsroom', *Sheffield & Rotherham Independent*, 14 October 1848, 5. In another example, the Glasgow Exchange was willing to pay an annual fee of £400 for an exclusive contract for news by telegraph in that city – an offer refused by ETC: 'Glasgow Exchange', *Daily News*, 3 January 1852, 2.

3.1.) shows, for instance, that ETC had ‘upward of 320 stations in Great Britain’, and many of these new telegraph offices sprang up in city centres, often close to stock exchanges, like in Manchester and Liverpool.

It was at around this time that the term ‘telegram’ came to be widely adopted by the public. According to an article published in the *Bradford Observer* on 1 July 1852, the term had first been coined earlier that year in America by the *Albany Evening Journal* to describe a ‘telegraphic despatch’. Initially associated with the transmission of news (telegraphic bulletins), the meaning later encompassed other telegraphic messages; although not before a short controversy over the use of the word by Lord Clarendon in 1857 – a word, Mr. Shilleto of Trinity College, Cambridge, argued, ought be ‘telegrapheme’.[208] This controversy did not escape *Punch* which published the following poem shortly afterwards:

> Here is a bother, here's a to-do.
> About using one letter instead of two!
> And why are the Greeks to teach us to call
> A thing the spalpeens niver heard of at all?
> (Unless you suppose the spark in the wire
> Was known to them by the name of Greek Fire).
> End it with Phi, or end it with Mu,
> What does it signify which you do?
> End it with Mu, or end it with Phi,
> The point's not worth a potaty's eye,

[208] ‘Telegram and Telegraph’, *John Bull,* 17 October 1857. The term ‘telegram’ was defined in 1869 as any message or communication transmitted by a telegraph: ‘An Act to Alter and Amend the Telegraph Act, 1868 (Telegraph Act, 1869)’, 9 August 1869, 32 & 33 Vic. Cap. 73.

Contemn such ulthrapedantic appeals,

And put your shoulders to these two wheels,

Reduce the charges, which now is plundering,

And teach the clerks to spell without blundering.[209]

With the growing popularity of telegrams, telegraph offices, which had been initially established in railway stations, were now becoming more conveniently located in town centres. By the end of 1868, the company had opened 1,289 telegraph offices for the public, including 459 rented from third parties such as railways, 664 fully-owned town offices and an additional 166 branch offices in larger towns and cities.[210] By then MTC and UKTC, ETC's main competitors, had an established presence in Britain, and the public had access to a total of 1,852 telegraph offices across Britain. However, many towns of less than 6,000 inhabitants were still without any telegraph facilities. There were also facilities used exclusively by the railways, and when all telegraph office facilities were put together, they amounted to 2,488 on 1st January 1869.

As the number of telegraph offices grew, so did the number of messages. Almost one hundred thousand messages had been transmitted by ETC in 1851, and at the end of 1859 their number had increased tenfold to 1,025,269 messages (see Figure 3.2. below). This growth continued unabated in the following ten years, with 5,655,999

[209] Anon, 'Telegraph and Telegram, by a Dublin University Poet', *Punch, or the London Charivari*, 24 October 1857.

[210] 'Opposition to Telegraph Bill Books (ETC 1855-1870)' , TGE/1/6, BT Archives.

inland messages transmitted in 1868 by the five largest telegraph companies (3,137,478 for ETC alone).[211]

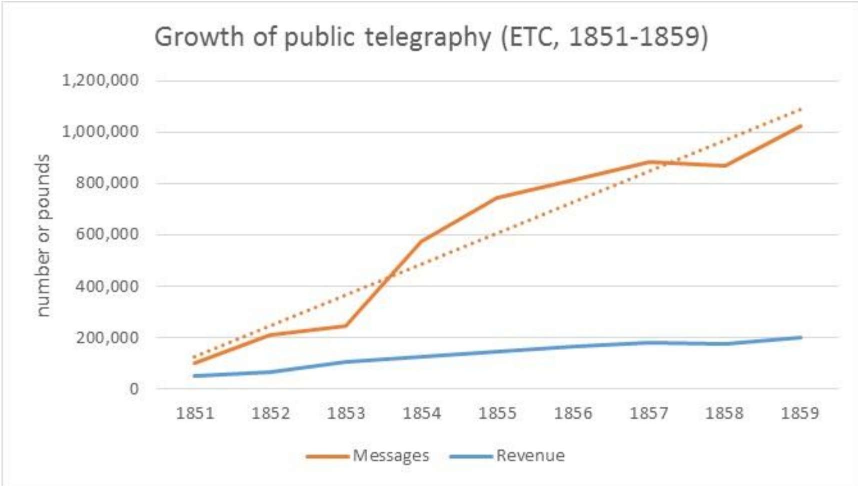

Figure 3.2. Growth of messages and revenue recorded by ETC between 1851 and 1859. The above figures do not include railway messages, nor intelligence subscriptions.[212]

The success of that steady growth can be attributed to the model adopted by ETC – a model that emulated to a large extent that of the Post Office and one which had already been largely assimilated by the general public: collection points where customers could take their written messages for subsequent transmission by electric telegraph (such messages had to be transmitted within five minutes of the time at which they were received at the counter), and a telegram delivery service that employed messengers (although, in this case, the messenger carried a single telegram, while the letter-carriers of the Post Office delivered several letters during their walk, unless it was an express delivery).[213] The similarity with the mail service was accentuated by the

[211] Kieve, *The Electric Telegraph*, 73.

[212] 'Opposition to Telegraph Bill Books (ETC 1855-1870)'.

[213] As seen in the previous chapter, it was not until the mid-1850s that pillar boxes or road-side letter boxes began to be available. In their absence, letters had to be deposited in post offices.

possibility of addressing a telegram to a post office for subsequent despatch as a conventional letter.[214] Naturally, the location of a telegraph office was critical to facilitate customers' access and reduce the time and cost of delivering telegrams, and in larger cities, branch offices were created to maintain proximity with customers and shorten the messenger's journey.

Initially, all messengers were directly employed by the company. As the business expanded and more telegraph offices were opened, messengers were also contracted out, especially in smaller towns. In 1867, for instance, ETC employed 1,191 operators and 764 messengers, but the number of employed messengers in 1868 remained stable at 759 messengers, despite the fact that the number of telegrams had continued to increase.[215] Off duty clerks could also act as messengers and be paid as such.[216]

Telegram porterage was carried out by boys, initially paid weekly wages but later paid by piece-work at the rate of one penny per message delivered. Each boy was able to deliver up to about thirty messages per day, thus earning between two and three shillings per day. In 1857, the volume of telegrams required the company's Central Office in Lothbury to employ 58 boys as messengers, while branch offices in London, such as the ones at the Stock Exchange, London Dock or Mincing Lane had only one messenger

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[214] Postmasters refused sometimes to sign the messengers' tickets, revealing a certain level of competition between the two services. 'ETC Third Quarterly General Meeting of Superintendents Reports' 30 June 1854, TGA/1/7/1, BT Archives.

[215] 'Opposition to Telegraph Bill Books (1860-1869) - ETC Number of Staff Members in Each District' , TGE/1/6, BT Archives. Kieve, *The Electric Telegraph*, 85. quoting the Report of the Treasury Committee on the Telegraph Service, 1875. It is interesting to note that by 1870, Scudamore had increased the number of messengers to 3,116. We can assume that messengers were all contracted by then. Hansard: 'Post Office - The Postal Telegraph Department - Resolution' (HC Deb Vol 228, 17 March 1876).

[216] 'Electric Telegraph Company Quarterly Meetings of Superintendents Reports (1854-1857)' 30 June 1854, TGA/1/7/1, BT Archives.

each, Fleet Street had five messengers, and the Strand 21. Liverpool in the meantime employed 21 permanent messengers, and Manchester 27.

Porterage of a telegram by a company's messenger was restricted to a three-mile radius from any office. The mode of delivery was specified by 'affixes'; for instance, 'MC' meant that the message was to be delivered by a company messenger in a cab, and 'SX' specified that the message was to be sent by Special Express, usually on horse. 'MH' meant that the message could be sent by man or horse to any distance, and beyond three miles, by fly, cab, stage-coach, railway or steam-boat. Many more options existed, and their multiplicity created a complex porterage tariff structure.

The charges for porterage were calculated according to distance and varied over the years. In 1863, for instance, porterage for the first half-mile was free of charge, then increased from 6d to 1s 6d up to a distance of three miles for a messenger on foot, and from 1s to 3s for a special express. London had its own rates of porterage, also free for half-mile and under, and then 3d for every half-mile beyond the first half-mile. At times, the porterage was as or more expensive than the message itself. It was reported in 1867 than a telegram from London to Ham, a district adjacent to Richmond, was a shilling but the porterage was eighteen pence because it was delivered from the telegraph office at Richmond which was three miles away, taking one hour to reach its destination.[217] In another anecdote, a gentleman told of his misfortune for living seven miles from a telegraph office, and having had to pay seven shillings in porterage for receiving a

[217] It was argued at the time that, had the post office in Ham acted as a telegraph office, the cost of delivering the telegram would have been cheaper. Edwin Chadwick, 'On the Economy of Telegraphy as Part of a Public System of Postal Communication', *Journal of the Society of Arts*, 1 March 1867, 222.

telegram of a trivial nature which had cost the sender only one shilling.[218] Indeed, one of the strongest arguments put forward by proponents of the nationalisation of the telegraphs at the time was the reduction of the distance between telegraph offices and the senders and receivers of messages, especially in rural districts, by leveraging the extensive network of post offices across the country to reduce the porterage charges.

Such charges, to which were sometimes added roaming fees when the company had to use a competing network to transmit a telegram, were prohibitive. For this reason, the service was not widely used by the general public. Still, usage grew steadily as telegrams were slowly adopted as an alternative to letters in business circles: in 1860 there was one telegram for 296 letters, by 1863 that ratio was one to 197 letters, and in 1866 one to 121 letters.[219] This take-up of telegrams, though, was still constrained by the high rates imposed by the telegraph companies for the transmission of messages. Prior to 1853, ETC's rates had been bespoke, with charges for each destination (town) pre-calculated and published. A telegram from London to Cheltenham, for instance, would have been charged at 7s 6d – a distance of approximately one hundred miles. From 1853 onwards, an attempt was made to simplify the rates, setting them at 2s 6d for twenty words for distances up to 100 miles and at 5s 0d beyond 100 miles. Then, in 1865, the transmission charges were finally set at 1s for twenty words for distances up to 100 miles, 1s 6d between 100 and 200 miles, and 2s beyond 200 miles. In other words, with the latest tariff it would still have cost at least a half-day's work for a messenger to send a telegram across London, assuming there was no additional porterage. Telegrams

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[218] 'Telegraphic Messages', *Pall Mall Gazette*, 15 November 1867, 3.

[219] Hansard: 'The Chancellor of the Exchequer Comments on the Electric Telegraph Bills' (HC Deb Vol 191, 1 April 1868).

remained a communication tool for professionals and the well-to-do classes of Victorian society.

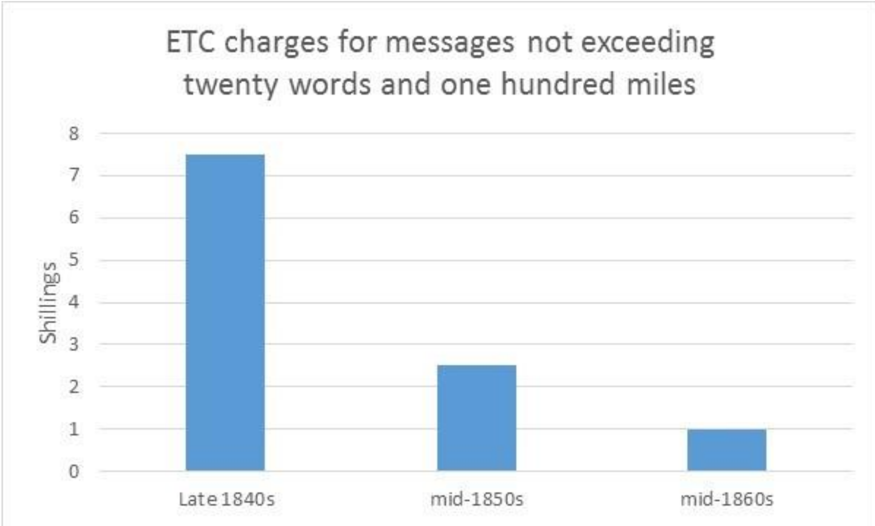

Figure 3.3. Evolution of ETC charges for messages of twenty words for a distance of one hundred miles (the reference taken for the late 1840s is London to Cheltenham). Source: BT Archives.

Earlier, in 1861, UKTC had started its operation between London, with its main office in Old Broad-street, and Liverpool and Manchester, differentiating itself from the other companies by establishing a telegram service with a uniform rate of one shilling per message of twenty words, irrespective of distance – hence its popular name: the 'Shilling Company'.[220] It had first been authorised by a Special Act of Parliament in 1851 (14 & 15 Vic. Cap. 137). However, Thomas Allan, the Scottish engineer behind it, had failed to raise the capital of £250,000 that he believed was needed to launch this ambitious and innovative undertaking, and the company remained dormant until

[220] In the advertisement section of *The Times* on 21 March 1864, for instance, a family residence to be let was said to be in a town (Rugby) where the 'Shilling Telegraph Company' had an office. See also 'The Shilling Company', *Caledonian Mercury*, 26 April 1864, 1.

1860.[221] It is interesting to note that the original prospectus, back in 1851, mentioned the name of Charles Wheatstone as a scientific adviser.[222] Furthermore, it was also mentioned that, in addition to providing public telegraphy, the company was planning to offer wires to be 'exclusively appropriated to Government departments, public companies, or private mercantile establishments, at an annual rent'. In effect, these were private wires, and this was perhaps the first reference to private telegraphy outside the field of railway applications.[223] However, the statute of the company changed in 1862 as a new UKTC Bill came into effect, replacing the special Act of Parliament established in 1851 – a statute which prevented the company from 'leasing any wire except with the consent of the Board of Trade'.[224]

No private wires were thus ever installed by UKTC.[225] Still, the company's original strategy was maintained, that is, to 'give to the Million the benefit of the great scientific discovery of the age'.[226] The idea of providing cheap telegrams to the public at large was borrowed from Hill's uniform penny postage concept: in a similar way, UKTC believed

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[221] The new Company's Act called for a capital of £150,000 which was taken up in a few days. The *Daily News*, 26 July 1860 and the *Caledonian Mercury*, 12 September 1860.

[222] 'The United Kingdom Electric Telegraph Company', *Morning Post*, 29 April 1853, 1.

[223] It will be recalled that the 1843 agreement discussed earlier had limited Wheatstone's involvement with telegraphy to lines not exceeding half a mile in distance.

[224] 'Uniform Charge for Telegrams', *Caledonian Mercury*, 5 July 1862, 2. As we shall see in the next chapter, the Telegraph Act 1863 prevented telegraph companies from renting private wires with one notable exception, that of the Universal Private Telegraph Company.

[225] A dispute between Thomas Allan and the United Kingdom Electric Telegraph Company in 1861 resulted in his dismissal. The legal action subsequently taken by Allan against the company forced the management to re-establish the company under a new Act, thus replacing the 1851 Act. The company also distanced itself from Allan's technology by adopting David Edward Hughes' type-printing telegraph in 1863.

[226] 'Manchester and the Surrounding Districts (Announcement of the Formation of UKTC)', *The Era*, 8 May 1853, 9.

that the adoption of a simplified tariff (irrespective of distance) and lower rates would boost usage, and at the same time enable the company to break into a market dominated by ETC, and to a lesser extent by MTC.[227] With ETC protecting jealously its quasi-exclusivity on wayleaves with the railways, UKTC had little choice but to turn initially to towpaths along canals to lay down its infrastructure. The initial line from London to Liverpool and Manchester was soon extended to serve many other places, although the company restricted its activities to principal towns in the country, mostly in England. As UKTC began to win customers and grab market shares from ETC and MTC, these two much larger competitors reacted by aligning their prices according to those of UKTC's, precisely on those lines where they competed with each other. The competitive advantage initially enjoyed by UKTC was quickly lost and the company began to struggle as the shilling rate was not sustainable without economies of scale. In July 1865, an agreement was eventually reached between UKTC, ETC and MTC to abandon the uniform rate of one shilling and adopt instead a distance-dependent tariff.[228] Nonetheless, UKTC's customers had experienced for four years the benefit of a tariff that closely resembled, in concept if not in monetary value, that of the uniform penny postage.

[227] A gain of thirty to forty per cent in efficiency was expected from a new system of electrical communication providing simplicity and economy of operation, based on the assumption that despatches could be telegraphed to distances of one thousand miles and even beyond without break or repetition, using Thomas Allan's relay technology and instruments: *Morning Post*, 29 April 1854 and *Daily News*, 26 July 1860.

[228] On 23 November, 1867 it was stated in *The Huddersfield Chronicle and West Yorkshire Advertiser*, that the experiment of the shilling rate was never allowed to have a fair trial as the company faced too strong competition, and 'being young and struggling, the directors gladly agreed to an arrangement with the other companies'.

3.3. Dear telegraph

UKTC's attempt at bringing down the price of telegrams had thus failed. Moreover, the addition of porterage charges often doubled or even tripled the cost of transmission. For instance, in 1866 the cost of transmitting a telegram of twenty words from London to Bristol was 1s 6d, but had the recipient lived between two and three miles from the nearest telegraph office, the total amount would have been 3s. Such a telegram would have been delivered probably less than two hours after it had been handed-over to a clerk at ETC's Central Office in Lothbury.[229] By comparison, a letter deposited in one of the Post Office's receiving houses in London would have taken much longer to reach the recipient, perhaps as long as 24 hours, even though the journey by train from London to Bristol was only four hours.[230] However, the letter would have also cost less – one penny,

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[229] ETC moved from 345 Strand to Founders' Court in Lothbury in January 1848. In addition to being highly functional, the location was also conveniently near to the Bank of England, the Royal Exchange and many other places of business in the City. The subscribers' room was an integral part of the building, unlike the previous one which had been located at 142 Strand across the old Central Station at 345 Strand. 'The wires from the several railway termini (were) brought through iron pipes, laid down under the pavement of the streets'. Having outgrown these premises, in February 1859 the company moved its General Offices a little further in Great Bell Alley, renamed in 1860 Telegraph Street by order of the 'Commissioners of the Sewers of the City of London, upon the memorial from the Electric & International Telegraph Company'. The public hall of the Central Station in Lothbury remained, and the building was eventually connected by 'pneumatic pipes' to Telegraph Street where all the instruments were located. 'The Electric Telegraph Company', *The Illustrated London News*, 22 January 1848, 34–36, 34. 'The Electric and International Telegraph Company, Great Bell Alley', *The Illustrated London News*, 31 December 1859, 649, 649.

[230] Such a letter would have been despatched from St Martin's-le-Grand, and it is interesting to note that, as part of its efforts for greater efficiency, the Post Office introduced pneumatic tubes between some district post offices to speed-up the conveyance of 'parcels, despatches and messages' within the metropolis: for instance, the tube installed by the Pneumatic Despatch Company between St. Martin's-le-Grand and Euston Station in 1861. The initial 1859 Act (22 & 23 Vic. Cap.137) was further extended in 1864 and 1872 (27 & 28 Vic. Cap.130 and 35 & 36 Vic. Cap.180) to connect 'their undertaking with the railways in the metropolis '.

delivery included – while its format would have provided a far greater freedom of expression than the self-imposed laconic (if not cryptic) style of the telegram.

The speed advantage of telegrams over letters came at a cost, and for this reason they remained the preserve of the stereotypical users: the professionals and the wealthy classes. The number of messages transmitted by ETC had been about one million in 1859 (see Figure 3.2.), and by 1868 that number had tripled.[231] This uptake was largely driven by professional usage, as evidenced by the range of options which had been tailored for businesses. The sender, for instance, could request an immediate response, prompting the messenger delivering the telegram to wait for an answer, which was either pre-paid (with the affix 'W.P.') or not (with the affix 'A.U.'). In effect, this feature created a time-lapse conversation between the parties, which would have been useful for transactions requiring a quasi-immediate acknowledgement, such as when brokering a deal or ordering goods.

However, many towns were not connected to a telegraph network, especially those not served by a railway line in rural areas.[232] As indicated earlier, ETC had a presence in 1,123 towns and cities across the country in 1868, which left many towns beyond the reach of telegrams. In such a case, the sender could ask for the telegram to be posted, and two options were offered: postage to be pre-paid from a specified post

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[231] The number of inland messages transmitted by ETC in 1868 was 3,137,478. Kieve, *The Electric Telegraph*, 73.

[232] The establishment of a telegraph office in a town was also an economic decision, as ETC shareholders expected a return on investment.

office (with the affix 'T.P.') or postage unpaid (with the affix 'G.P.').[233] This complementarity between public telegraphy and postal services, even if only unilateral, reinforced their commonality of purpose and, indeed, their rivalry, thus auguring the future battle between the Post Office and the private telegraph companies prior to their nationalisation.[234]

Moreover, the relative scarcity of telegraph offices and their frequently inconvenient locations contrasted with the ubiquity of post offices. By 1865 the Royal Mail had already a network of 11,316 post offices in the United Kingdom, of which 10,508 were sub-post offices located in all the towns of the country, large and small.[235] Perhaps the strongest argument later put forward by the Post Office for the nationalisation of the telegraph was arguably this extensive network of post offices, which, coupled with the even larger network of 15,202 road letter-boxes, could make the collection and delivery of telegrams much more efficient than the infrastructure then offered by the private telegraph companies.

But the situation was entirely different within large cities, especially in London. Here, intra-urban telegrams offered no benefit over letters. With its hourly deliveries, the London District Post (which, by the 1860s, had already merged with the General Post

[233] Telegraphic messages forwarded to a post office were to be left there until called for and were to be treated as ordinary unpaid letters. Raguin, *British Post Office Notices 1666-1899*, 5 (1850-1859):370.

[234] The rivalry between the telegraphic and postal services was perceptible as early as 1855 when some postmasters were reported to have refused to sign the (telegraph) messenger's ticket for telegrams to be posted. 'ETC Sixth Quarterly General Meeting of Superintendents Reports' 26 April 1855, TGA/1/7/1, BT Archives.

[235] Lewins, *Her Majesty's Mails*, 252.

Office) was able to deliver a letter within two hours of collection.[236] Indeed, a letter sent from Cavendish Square to Grosvenor Square was not required any more to go first to St. Martin's-le-Grand to be sorted and re-distributed, as was the case earlier. Instead, it went directly to the recipient's branch office, as each district had its own sorting and despatching operations. A telegram could actually take longer to deliver than a letter: we learn from *The Leeds Mercury* dated 4 July 1868 that during the examination of the Electric Telegraph Bill on 1 July 1868, Frank Ives Scudamore (more on this Post Office official in the next section) had told the Select Committee that the Post Office had previously forwarded telegrams to all part of the metropolis 'within the radius' and found that they took much longer to deliver than 'if sent by omnibus'. Despite the high cost of its frequent deliveries of letters, the postal district system was nevertheless extended progressively beyond London to benefit other large provincial towns. By 1866, for example, Liverpool had been divided into four districts, and it would have taken only three hours for a letter posted in one part of the town to be delivered in another part of the town at certain times of the day.[237]

Moreover, the delivery of letters was free within three miles, unlike the half-a-mile concession given by the telegraph companies for the delivery of telegrams. The transmission of a telegram from one part of the metropolis to another was charged at

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[236] Although a branch of the General post Office, the London District Post maintained an independent operation. For instance, there was a separate network of pillar boxes for the London District (painted in red) from the network of General Post boxes for inland, colonial and foreign mails (painted in black). Raguin, *British Post Office Notices 1666-1899*, 5 (1850-1859):320.

[237] 'Twelfth Report of the Postmaster-General on the Post Office', 1866. 6.

6d but porterage often brought the price up to 1s, and at times even more.[238] This made 'urban telegrams' uncompetitive against letters: for London, as for many other large cities, a letter was a very efficient and convenient form of written urban communication, and by far the cheaper option. The volume of urban telegrams was probably very low. No attempt was made apparently to report them separately, but a side-by-side comparison of the overall number of inland telegrams transmitted and letters conveyed provides a clear evidence that the latter was the dominant form of written communication in the cities. In 1868, in excess of 110 million letters were delivered by the London District Post (letters which remained within the metropolitan area), out of a total of more than 850 million letters for the whole of the United Kingdom.[239] In that same year, as we saw earlier, the combined volume of inland messages from the five largest private telegraph companies across the country was slightly less than six million. In other words, just prior to nationalisation, the overall number of telegrams was less than one per cent of the total number of letters (and other packets paying full letter rates) conveyed in the country, or about five per cent of the traffic reported by the London District Post alone.

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[238] Comments from the Chancellor of the Exchequer, Mr George Hunt, during the Commons Sitting on the Electric Telegraph Bill. Hansard: 'Electric Telegraphs (Re-Committed) Bill - Committee' (HC Deb Vol 193, 21 July 1868).

[239] Figures extracted from: 'Statement of the Number of Letters, Book Packets and Newspapers, Delivered in One Week of Each Calendar Month in the United Kingdom (1855-1876)', Post 19/91, BPMA.

THE DISTRICT TELEGRAPH.

INVALUABLE TO THE MAN OF BUSINESS.

First Partner (to Second ditto). "WHAT AN AGE WE LIVE IN! TALK OF THE INTRODUCTION OF STEAM OR OF GAS! JUST LOOK AT THE FACILITIES AFFORDED US BY ELECTRICITY. IT IS NOW SIX O'CLOCK, AND WE ARE IN FLEET STREET, AND THIS MESSAGE WAS ONLY SENT FROM OXFORD STREET YESTERDAY AFTERNOON AT THREE!"

Figure 3.4. A satirical view of the tardiness of urban telegrams. A letter posted at the same time as the telegram would have arrived on the same day, probably about two hours later. Here, the experience with a telegram may have been exagerated, but it illustrates the challenges faced by urban telegrams when competing with the London District Post Office .[240]

The number of collection points maintained by the London District Post dwarfed the handful of telegraph stations. Within what the London District Post defined as 'town delivery', that is the portion of the ten districts within a three mile radius of the General

[240] John Leech, 'The District Telegraph', *Punch, or the London Charivari* 44, no. 1122 (10 January 1863): 20.

Post Office, there were 205 receiving houses plus an additional 98 pillar-boxes where letters could also be posted in 1860.[241] Outside the town delivery zone, there were 391 receiving houses and 126 pillar-boxes covering one hundred towns in the suburbs of London. Besides, apart from the large number of collection points and the high frequency of deliveries, the Post Office had another significant advantage over its telegraph rivals – an advantage which it protected jealously: its monopoly on delivery. By the Post Office Management Act, 1837 the Post Office had been confirmed in its monopoly on the conveyance of letters, with one exception: 'Letters sent by a messenger on purpose concerning the private affairs of the sender or receiver thereof.'[242] In 1868, the Circular Delivery Company was formed to provide a circular delivery mechanism exclusively for its members, as it would have been illegal to do so for any third party. However, it soon began to distribute a business circular addressed outside its membership, charging one farthing per envelope, and was successfully sued by the Postmaster-General for having breached the privileges of the Post Office.[243] Similarly, telegraph companies were restricted by this Act. Telegrams were delivered in postal envelopes just like letters (see Figure 3.1.) but porterage had to be treated as 'messenger on purpose', which prevented the companies from optimising resources when and where possible (for instance, by grouping telegrams along a route like the letter-carriers) to reduce delivery charges.

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[241] Anon, *British Postal Guide - Containing the Chief Public Regulations of the Post Office with Other Information.* (London: Eyre and Spottiswoode, 1860), 160–204.

[242] 'An Act for the Management of the Post Office', 12 July 1837, 1 Vic. Cap. 33.

[243] Hansard: 'Post Office - Inland Postage' (HC Deb Vol 195, 6 April 1869). See also: 'Post Office', *The Times*, 26 June 1868.

The commonality of purpose between letters and telegrams made the monopoly on the conveyance of letters granted to the Post Office all the more visible, and a growing number of contemporaries were drawing attention to the potential benefits of making the telegraphs an integral part of the Post Office. It is to this process of nationalisation that our attention will now turn.

3.4. The politics of appropriation

> Under the existing conditions of dearness and great incompleteness in England, the telegraph may be said to be a class telegraph, in regular use only for stock-brokers, produce-brokers, and the higher class of professional men. It cannot be called a domestic or a general public telegraph. For domestic use, it is generally only available to very well-to-do classes – the few. For the higher middle classes, its use is chiefly confined to extraordinary occasions, to death, to mortal sickness or impending calamity… To the many, the lower middle classes and the labouring classes in towns, the present charges may be said to be entirely prohibitory; as also to the agricultural classes.[244]

In the early 1860s, Edwin Chadwick had taken a keen interest in telegraphy during his investigation of the technology as a means of establishing a more efficient police system (see more on this topic in Chapter 4). By the late 1860s, however, the social reformer had become increasingly critical of the shortcomings of the strategy adopted by the private companies. The epigraph is an excerpt from a paper read by Chadwick on 27 February 1867 during a meeting of the Society of Arts. Advocating the removal of 'excessive charges on transit, as well as fiscal and other obstructions to free inter-communication', the paper was a plea for the Post Office to take control of telegraphy as a work of necessity and public convenience. Chadwick's paper resonated well with the audience which included Scudamore, as all but one member who had spoken during the ensuing discussion supported his views. As the epigraph shows, Chadwick's criticism

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[244] Chadwick, 'On the Economy of Telegraphy as Part of a Public System of Postal Communication', 223.

of the existing system of telegraphy was levelled mainly at its discriminatory nature. Like a growing number of his contemporaries, he was a fervent advocate of a public system of telegraphy – one that would leverage the large resources afforded by the Post Office. Such a view was not novel: the Board of Trade had received a proposal from Captain Galton (later Sir Douglas Galton) in 1852 to 'bring the telegraphs under the Post Office' – a proposal rejected by the Postmaster-General of the day, Lord Hardwicke.[245] In 1865, however, the instigator of a Bill to nationalise the telegraphs was the Liberal Postmaster-General himself, Lord Stanley of Alderley. Judging by the strong support given by the Chambers of Commerce across the country, and by the reaction of the newspapers which had expressed 'great dissatisfaction with the present arrangement', public

[245] Barton mentioned that the first call for nationalisation was made in 1854 (see below), while in fact it should be attributed to Captain Galton in 1852. Galton's father-in-law, Mr Nicholson of Waverley Abbey, sent the proposal to Rowland Hill in 1852. Having received a favourable opinion from Hill, Galton sent the proposal to the Board of Trade, whence it was referred to the Postmaster-General, Lord Hardwicke, who rejected the proposal. Hill and Birbeck Hill, *The Life of Sir Rowland Hill and the History of Penny Postage*, 83. Eleanor C. Smyth (Hill), *Sir Rowland Hill - The Story of a Great Reform Told by His Daughter* (London: T. Fisher Unwin, 1905), 267. Two years later, in 1854, another call for nationalisation was made by Andrew Wynter in the *Quarterly Review*. Andrew Wynter, 'The Electric Telegraph', *Quarterly Review* XCV (July 1854): 62–85. In that same year, Thomas Allan (UKTC's founder), published a paper titled 'Reasons for the Government Annexing an Electric Telegraph System to the General Post Office' in which he proposed a charge of one shilling for twenty words (*Account of the Celebration of the Jubilee of Uniform Inland Penny Postage* (London: General Post Office, 1891), 22.). Then, in 1856, Frederick Baines, an officer in the General Post Office, submitted to the Treasury a plan for the annexation of the telegraphs, this time with a charge of 6d for messages of twenty words ('The State Telegraphs', *Nature - A Weekly Illustrated Journal of Science* V (30 December 1869): 232, http://uwdc.library.wisc.edu/collections/HistSciTech.). Finally, the idea of placing telegraphic communication in the hands of the Post Office was reinforced in 1858 by John Lewis Ricardo, then ETC's chairman, in his controversial memorandum ('in support of the expediency of the telegraphic communication in the kingdom placed in the hands of her Majesty's government') to William Gladstone in which he thought it 'desirable that the telegraphs of this country should be placed in the hands of the State'. It is interesting to note that Gladstone, at the time, had referred the matter to Sir Alexander Spearman (Assistant Secretary to the Treasury) and Frank Ives Scudamore. This memorandum is likely to have influenced Scudamore's inquiry into the telegraphs. Hansard: 'Electric Telegraph Bill'. *See also:* 'Multiple News Items', *Standard*, 20 April 1868, 4.

opinion was in favour of the Bill and the Postmaster-General decided at that point to intervene.[246]

Indeed, from the time the idea of nationalisation had first been suggested in 1852 to the mid-1860s, the Post Office had been under growing pressure to get involved with telegraphic communication. In September 1865, the Postmaster-General directed Frank Ives Scudamore to inquire into the growing public discontent about the telegraphs, and to report whether the telegraphs might be beneficially operated by the Post Office and what would be the cost of such a decision. Scudamore's report to the Postmaster-General in July 1866 favoured the purchase of the private telegraph companies, the development of the telegraph network and the establishment of a uniform rate of one shilling for twenty words across the country. He argued that the popularity of the telegraph on the Continent, especially Belgium and Switzerland, was due to their integration in the postal system of these countries and the adoption of low charges. Observing that only just over a quarter of the 10,000 towns served by the Royal Mail had access to telegraphic services, he contended that the slow growth of the telegraph in Britain was because the companies were only interested in serving high-volume

[246] From 1866 to 1868, there were a number of petitions to the House of Commons in favour of the proposal, including 77 from Chambers of Commerce and 177 from newspapers (especially provincial). 'Electric Telegraph Bill - Second Reading' (HC Deb Vol 192, 9 June 1868). See also: 'House of Commons', *The Times*, 9 June 1868, 6. During subsequent debates, a controversy arose about these petitions: the seemingly high number (319) of petitions opposing the Bill was criticised for being made up of nearly every shareholder of the main companies and from the railways. George Leeman, the Liberal MP from York who had interests in the railway industry and was a strong opponent of the Bill, suggested that provincial daily papers had been incited by the postmasters to petition for the Bill, to which the MP from Liverpool (Mr S.R. Graves) responded that in his city nearly every merchant and broker of eminence in the city, amounting to over 600, had given their signature spontaneously.

profitable routes and ignored the rest of the country.[247] Scudamore concluded that an estimated £2.4 million would be required to purchase the assets and the rights of the four major companies (ETC, MTC, UKTC and RTC), and that a further one hundred thousand pounds would be required to extend the network.

On 16 November 1867, *The Times* announced that the draft Bill had been finalised by the Post Office, but three months later Scudamore was still updating his estimation of the cost of purchase – this time to nearly £3 million. Finally, on 1 April 1868, the Chancellor of the Exchequer introduced the Bill to Parliament, together with Scudamore's updated report. Exactly four months later, on 31 July 1868, the Postmaster-General was given the authority 'to acquire, work and maintain electric telegraphs' by the Telegraph Act, 1868.[248] There was no obligation on the part of the Postmaster-General to purchase the undertakings of the private companies: the Act gave him the power to negotiate and acquire the undertakings, should he choose to do so.[249] However, once the undertaking of one company had been purchased, the other companies were given the option to force the Postmaster-General to purchase theirs, so as to prevent market distortion or protect them from a devaluation of their stock. The general terms of the cost of purchase of the undertakings had been settled

[247] In 1866, only 144 towns with more than 2,000 inhabitants, out of a total of 486 towns, had access to the telegraph with the town limits. Anon, 'Postal Telegraphy', *Chambers's Journal of Popular Literature, Science and Arts*, 6 May 1871.

[248] 'An Act to Enable Her Majesty's Postmaster General to Acquire, Work, and Maintain Electric Telegraphs (Telegraph Act, 1868)', 31 July 1868, 31 & 32 Vic. Cap.110.

[249] The definition of the undertakings included all the physical assets, such as properties, wires, posts, pipes, and instruments, as well as the rights, privileges and patents.

previously, and amounted to twenty years of the net profits.[250] There remained, of course, the most important part to settle: the actual valuation of the net profits, the tangible assets and the goodwill. The Act also left to the discretion of the Postmaster-General, with the consent of the Treasury, the decision to regulate the industry and fix the charges for the transmission of messages.[251] The newspapers, which had been a vocal proponent of a public service, were granted a privileged tariff.[252]

As the Bill was being discussed in Parliament a new estimation of the cost of purchase had by then put the total at £6 million, plus the extensions, but there was still confidence that the net income of the telegraph business would amount to three and a half to four per cent of the cost of purchase, and therefore that no additional levy would be imposed on the taxpayer. The Disraeli government had rushed the Bill through Parliament to take credit for it before the general election; but with the passing of the Bill, it was the new Gladstone government – which opposed the Bill during the debate – that had now to overcome the challenges of overseeing its implementation.[253]

Taking office in December 1868, the new Liberal Prime Minister was facing a crisis: the Telegraph Act, 1868 had critically omitted to give monopoly status to the Post Office.

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[250] The companies had initially proposed twenty five years, in line with the guarantees given to the railway companies with the Railway Act, 1844 (7 & 8 Vic. Cap. 85). They settled eventually for twenty years.

[251] The new uniform charges were to be made irrespective of distance, and the rates were not to exceed 1 s. for 20 words. The destination address was not to be counted in the word count and this tariff was inclusive of the delivery within one mile of the telegraphic office or within the limit of the town postal delivery of that office if a head post office.

[252] The rates were not to exceed 1 s. for 100 words between 6 pm and 9 am, and 1 s. for 75 words between 9 am and 6 pm.

[253] The Bill was opposed mainly because it was promoted by the Tories. 'The Electric Telegraph Bill', *The Times*, 22 July 1868, 9.

This had been, in part, because of the rush to pass the bill, but also because of a strong opposition in Parliament, as opponents of the Bill had widely believed that a monopoly would kill progress and, in the end, defeat its purpose. However, the cost of the acquisition was now so large that many sought reassurances that this money would not be wasted because there was a significant risk that private companies, those that had not been acquired and possibly new ones, would take advantage of the uniform rate envisioned under the scheme by undercutting the Post Office in profitable markets while ignoring the others. A new Bill was introduced in July 1869 and passed on 9 August 1869.[254] The Telegraph Act, 1869 gave the Post Office a monopoly over the telegraphs for the purpose of developing a service to the public.[255]

In his history of the nationalisation of the telegraphs, Perry concluded that this event is to be regarded as 'a significant case of government expansion' which required a compromise on the part of the committed capitalists involved in the process and those endorsing the dogma of *laissez-faire*.[256] The growth in bureaucracy (the recurrent theme in Perry's narrative) cannot be denied since the Post Office had to absorb the private companies and scale up the telegraph operation, but political ideology seems to have played only a minor role in the nationalisation.[257] The private telegraph companies, and to a lesser extent the railway companies, initially opposed the Bill more as a negotiation

[254] 'Telegraph Act, 1869'.

[255] The definition of the term telegraph, as given in Article 3 of this Act, came back to haunt the government during the development of the telephone, as we shall see in chapter 6.

[256] Perry, *The Victorian Post Office*, 118. See also from the same author: Perry, 'The Rise and Fall of Government Telegraphy in Britain'. Perry, 'Frank Ives Scudamore'.

[257] According to Daunton the workforce of the Post Office increased from 25,192 in 1870 to 46,956 in 1880. Daunton, *Royal Mail*, 194.

tactic than for any other reason: as we saw earlier, the numerous calls for the Post Office to take over the telegraphs had long alerted the companies to their potential, if not ineluctable appropriation by the Post Office.[258] The maximisation of the shareholders' return on investment was what was at stake; it was not an ideological stance.[259]

Moreover, the campaign for nationalisation, Perry stated, 'might have remained stalled, if it had not been for [a] crucial miscalculation' on the part of ETC, MTC and UKTC in July 1865: the setting of a uniform tariff between them.[260] This idea was also suggested earlier by Simmons when he wrote that the matter might have rested with the Telegraph Act, 1863 if the companies had not decided to increase the charges in such a way.[261] Both implied that this new tariff was perceived as an act of provocation which fast-tracked the nationalisation. The argument is unconvincing. In reality, the rate agreed in July 1865 remained one shilling, as before, but only for distances of up to one hundred miles. What the companies agreed to was the abandonment of the shilling rate, irrespective of distance, that UKTC had pioneered. With this new uniform tariff, a

[258] In addition to the 10 petitions against the Bill from the telegraph and railway companies (there were in excess of 250 agreements in place between the telegraph and railway companies, and the latter had a beneficial interest in the former), there were 319 petitions against the Bill from individuals – all individual shareholders of the telegraph companies. The Chancellor of the Exchequer claimed during the debate that 'the telegraph companies were more interested in the terms they would get from the purchase of their lines than in anything else'. 'Electric Telegraph Bill - Second Reading', 9 June 1868.

[259] Ibid. Initially, the companies demanded to be paid 25 times the average net profit of the past three years, as the railway companies had been offered in the Railway Act, 1844; but they settled eventually to 'Twenty Years Purchase of the Net Profits' during the year ending 30 June 1868 (Telegraph Act, 1868). It is interesting to note that the shares of all major telegraph companies rose from 144-148 (1 November 1867) to 164-169 (8 May 1868), a fourteen per cent increase in just seven months.

[260] Perry, *The Victorian Post Office*, 92.

[261] Simmons, *The Victorian Railway*, 227.

telegram of twenty words transmitted to a distance of over 200 miles was now charged at two shillings – the double of what UKTC had previously charged. This was no provocation; it was simply a sound business decision on the part of the firms to ensure profitability of operations. Indeed, Alexander Angus Croll, UKTC's chairman (a chemist and entrepreneur who had previously founded the Great Central Gas Company) reported at the Ordinary Meeting of 29 July 1865 that despite their earnest efforts to make the shilling rate remunerative, the company had not been able to earn a single dividend four years into its operation.[262]

It is undeniable that some customers felt disadvantaged by the distance-dependent uniform tariff, but the main issue faced by the country was not the affordability of telegrams – it was, rather, the lack of telegraph offices. The companies had adopted an operational model that closely resembled that of the Post Office, and this had given their customers, and the public at large for that matter, a reference point from which to judge them. I use here the (rather nebulous) term 'public' purposefully to describe non-users of public telegraphy, and especially the category of non-users described by Sally Wyatt *et al.* as the 'excluded' – those who may have wanted to use public telegraphy but did not have access to it.[263] Such non-users played an important

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[262] 'United Telegraph Company', *Morning Post*, 31 July 1865. See also Kieve, The Electric Telegraph, 67. and also: Grace's Guide to British Industrial History: http://www.gracesguide.co.uk/Alexander_Angus_Croll, last accessed 13 December 2014.

[263] In her empirical study of the Internet, Wyatt argues that something is to be gained from exploring non-users of a technology, which she categorises as 'resisters', 'rejecters', 'excluded' and 'expelled', - as there may be different policy implications for different categories. She also suggests more nuanced categories, including: forced, reluctant, partial, selective and surrogate users. Sally Wyatt, Nellie Oudshoorn, and Trevor Pinch, 'Non-Users Also Matter: The Construction of Users and Non-Users of the Internet', in *How Users Matter - The Co-Construction of Users and Technology* (Cambridge, Mass.: The MIT Press, 2005), 68. Partly

part in the social construction of public telegraphy by adding to the mounting pressure on government, and the Post Office in particular. Capturing the mood of the nation, as he often did, Dickens wrote in 1869 that the main reason for the public's frustration was that 'the existing telegraphic system [was] mainly defective in this respect: that the telegraph offices are situated at railway stations, and out of the principal centres of business and population'.[264]

In fairness to the companies, the Royal Mail had time to build the postal network over many decades, even centuries. The companies, in contrast, were still expanding their transmission networks in an effort to 'overtake' the mail-trains on selected routes (or gain a competitive advantage over each other). Nonetheless, they would have been well advised to recall the postal reform debates because Rowland Hill had argued at the time that the conveyance of letters was only a small part of the Post Office operation. Hill had stressed that the collection and delivery of letters were what mattered most: not only as far as costs were concerned, but also from a customer service perspective. The limited availability of telegraph offices created an 'electric divide' – there were those who had access to telegram facilities, and the others. The discontent grew because, even to the uninitiated public, the comparison with the Post Office was all too apparent. A telegram, like a letter, was handed over to a clerk in a receiving-house to be forwarded to the recipient. It was delivered in an envelope, by a messenger-boy (just like a letter-

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based on an earlier taxonomic work: Sally Wyatt, Graham Thomas, and Tiziana Terranova, 'They Came, They Surfed, They Went Back to the Beach: Conceptualising Use and Non-Use of the Internet', in *Virtual Society? Technology, Cyperbole and Reality*, ed. Steve Woolgar (Oxford: Oxford University Press, 2002).

[264] Charles Dickens, 'Saint-Martin's-Le-Grand Adopted Child', *All The Year Round* 2 (New Series), no. 40 (4 September 1869): 325. As noted earlier, Dickens had already pointed out this issue in 1850 (cf. Wings of Wire).

carrier of the Post Office), and it even used stamps as a way to indicate payment. The companies had clearly underestimated the impact that such a comparison would have on the perception of their services. This was the main reason for their downfall.

The companies had perhaps hoped that the vastly superior speed of telegraphic communication would offset their limited presence in towns and cities. But that was not the case, as both users and non-users sensed the functional overlap that existed between letters and telegrams – an overlap which accentuated the rivalry between the Royal Mail and the telegraph companies. In a way, the companies had fallen victim to the success of the telegraph, and the public saw in the ubiquitous post offices the solution to the scarcity of telegraph offices.[265]

I contend that nationalisation would not have taken place had the companies adopted a different model – one which would not have created a rivalry between the Post Office and the telegraph companies – one which would not have suggested an analogy between telegrams and letters. What if, for instance, ETC had, instead of building an 'electric post office' from the ground up, concentrated their efforts on creating efficient 'electric highways' to convey telegrams on behalf of the Post Office (similar to the mail-trains operation).[266] Or else, what if the sender of an 'electric message' had not been required to hand it over at a collection point, and if a messenger

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[265] Several petitions from the Chambers of Commerce were presented to the House of Commons in 1866 and 1867 in support of a plan for combining the postal and telegraphic systems of the country. Anon, 'The General Post Office and the Electric Telegraph', *The British Quarterly Review* 45 (1867): 442.

[266] The Post Office employed telegraphs for internal communications as early as 1848, and was well aware of their benefits and ETC's attempt to establish a telegram service. In 1849 there was also an agreement between Ricardo and Hill for the right to transmit and receive internal messages at the low rate of one shilling for ten words. Hill and Birbeck Hill, *The Life of Sir Rowland Hill and the History of Penny Postage*, 83.

boy had not been needed to deliver the transcript to the recipient (in effect, eliminating any human mediation in the process)?

Such counterfactuals would not have made possible a one-to-one comparison with the mail service, and events would have taken a very different turn indeed. I postulate, therefore, that the rivalry between the Post Office and the telegraph companies was a critical factor behind the nationalisation – a factor far more important than the issue of affordability of telegrams, the growth in government or any political ideology consideration. This is more than a hypothesis: Article 8 of the Telegraph Act, 1868 ('Provision as to Purchase of certain Undertakings herein named') only referred to ETC, MTC, UKTC and RTC, with UPTC and LDTC only mentioned in the schedule that listed existing companies. Indeed, in response to a question by UPTC, the Postmaster-General confirmed on 10 August 1868 that the government was not prepared to purchase the private telegraphs.[267] Moreover, Scudamore wrote in 1871:

> The original scheme of the Post Office did not contemplate any interference with the companies which had been established for the purpose of setting up and maintaining private telegraphic communication between the offices and wharves or warehouses or factories of commercial firms. When, however, the Bill of 1868 was before the parliamentary committee, the chief of these companies, the Universal Private Telegraph Company, contended that their business would be destroyed by the introduction of a low and uniform rate for messages, and succeeded in establishing their claim to have their undertaking purchased by the Government.[268]

In other words, Scudamore never intended to take over UPTC because the model this company had adopted for telegraphic communication (the model described in the second counterfactual, that is, private telegraphy) was radically different from existing

[267] 'Purchase by the Post Office of the Universal Private Telegraph Company - Part 1', Post 30/311B, BT Archives.

[268] 'Report by Mr. Scudamore on the Re-Organisation of the Telegraph System of the United Kingdom presented to the House of Commons by Command of Her Majesty', 1871. 37.

postal services.[269] UPTC, as I describe in the next chapter, championed private telegraphy in the 1860s. Private telegraphy eliminated human mediation: electric messages were transmitted directly from sender to recipient via private wires. There was no need for clerks, operators and messenger-boys in the middle. There was no need, therefore, to build a vast network of collection points to serve customers. Had this model been chosen by the companies, the nationalisation of the British telegraph industry would have been unlikely. As will be seen in Chapter 5, UPTC asked the Postmaster-General that the company be taken over along with the other companies and, as a result, the Telegraph Act, 1869 added UPTC to the list of companies to be appropriated, valuating the acquisition at £184,421.[270] It also empowered the Treasury to raise seven million pounds for the acquisition of all the undertakings.

The Post Office took over the management of the telegraphs in January 1870. A year later, more than 1,300 new telegraph offices had opened, in smaller towns and villages, bringing the total to more than 5,000; and nearly twelve million telegrams were transmitted in that year, twice as many as in 1868.[271] In addition to the cost of appropriation of the companies, Scudamore had revised the cost of extending the telegraph service to be no more than £200,000. By September 1873, however, the Post Office had spent £2,130,000 on such extensions, and in 1877, the total cost of acquisition

[269] Another reason for not nationalising the private wires was discussed in the House of Commons, and it related to the safety of the railways (the use of private wires from station to station to regulate the traffic). The Chancellor of the Exchequer had stated that leaving these wires under the control of the railways was thought to be the best option. 'Electric Telegraph Bill - Second Reading', 9 June 1868.

[270] LDTC was also added with a valuation of £60,000.

[271] 'Eighteenth Report of the Postmaster-General on the Post Office', 1872. 11.

and extensions had risen to £10,250,000, and there were still claims to be settled with the railway companies.[272]

3.5. Conclusion

This chapter explored the early stage of the development of public telegraphy under the private telegraph companies. I have shown that the breakdown of the partnership between Cooke and Wheatstone was at the origin of public telegraphy as it enabled Cooke to set up ETC independently from Wheatstone. In the process, however, Cooke stifled the promising step-by-step technology – a technology which, fifteen years later, became a salient feature of private telegraphy. Moreover, the settlement reached on 27 April 1841 appears at first glance to vindicate Cooke's claim of priority over the design of the electric telegraph and relegate Wheatstone to a secondary role of scientific advisor, but the 'statement of fact' was not about intellectual ownership – it meant to reflect a commercial reality, that of Cooke's prominent involvement with the railway industry. On the contrary, the much less publicised ancillary agreement attached to the main award confirmed Wheatstone's ownership of the step-by-step technology, the machine represented in the joint patent of 1840: the precursor of the ABC instrument.

Initially, the electric telegraph was not associated with telegrams. ETC was formed in 1845 with the intention of selling private telegraphy to the railways. The concept of public telegraphy came *a posteriori* as an extension of the infrastructure deployed for

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[272] The following Acts of Parliament procured the £10,250,000: £7,000,000 on 9 August 1869 (Telegraph Act, 1869), £1,000,000 on 14 August 1871 (An Act for enabling a further sum to be raised for the purposes of the Telegraph Acts, 1868 to 1870), £1,250,000 on 5 August 1873 (An Act for explaining the Telegraph Acts, 1868 to 1871, and for enabling a further sum to be raised for the purposes of the said Acts and of the Pensions Commutation Act, 1872), and two further payments of £500,000 each on 27 March 1876 and 2 August 1877.

the railways, which included the network of telegraphic wires laid alongside railway tracks and the telegraph offices set-up in railway stations – later acting as message collection points for the public. With the employment of messengers, ETC added a telegram delivery capability and was thus able to provide public telegraphy using a model that closely resembled that of the Post Office. However, the cost of the service was prohibitive and customers were, as a result, mostly professionals. Competitors entered the market, and one in particular, UKTC, emulated Rowland Hill's uniform penny postage concept, offering lower rates of transmission, irrespective of distance. Possibly influenced by Wheatstone, UKTC also intended to offer private telegraphy. However, a revision of the statute of the company in 1862 revoked that possibility. UKTC undoubtedly increased the popularity of the electric telegraph and forced ETC's and MTC's prices down until, in 1865, the three companies agreed to establish the common rates of 1s for twenty words for distances up to 100 miles, 1s 6d between 100 and 200 miles, and 2s beyond 200 miles.

Despite their prohibitive cost, the number of telegrams transmitted increased steadily to reach nearly six million in 1868, driven mostly by business needs. They were used mostly for inter-urban communication between the largest towns and cities. Smaller provincial towns and villages lacked telegraph facilities, but the sender of a telegram had the possibility of requesting its delivery from a nearby telegraph office via the postal system. This arrangement was of great benefit to the telegraph companies but immaterial to the Royal Mail as the number of telegrams was dwarfed by the huge volume of letters handled by the Post Office: telegraphic despatches represented less than one per cent of mail activity. This arrangement, however, emphasised the commonality of purpose of telegrams and letters. While telegrams were usually a faster means of communication for inter-urban messages, they could not compete with the highly efficient system of district posts developed in large cities, especially in London. For as little as a penny, a letter could be sent and delivered within the metropolis in just two hours – a performance that telegrams could equal and potentially exceed, but only at a much higher cost, and with considerably more restrictions on the number of words transmitted.

Still, the main challenge faced by the telegraph companies was not the affordability of telegrams but the lack of telegraph offices, as this situation created a sense of great incompleteness which divided the country into 'haves' and 'have-nots'. The analogy between telegrams and letters made the comparison with postal services all too apparent as the public saw in the ubiquitous post offices the solution to the scarcity of telegraph offices. As public discontent grew, so did the idea of nationalising the telegraphs. It had first been proposed in 1852, and many more calls for taking over the companies were issued in the following years. In 1865, the government felt that action needed to be taken, and the inquiry led by Scudamore resulted in the Telegraph Acts of 1868 and 1869, which authorised the appropriation of the companies and gave the Post Office a monopoly over the telegraphs for the purpose of establishing a public service. Political ideology and the growth of government played a role in this nationalisation. However, by emulating the Post Office, ETC (and later MTC and UKTC) had created an expectation of service availability; they had become, by association, 'public institutions of necessity'. In other words, the rivalry that existed between public telegraphy and postal services was another factor in the nationalisation. Had ETC pursued the business of (railway) private telegraphy as was its intention in the first place, the nationalisation may have never taken place. In an irony of history, the nationalisation of public telegraphy also caused the nationalisation of private telegraphy, which was never targeted for nationalisation in the first place. It is to this model of telegraphic communication that our attention will now turn.

Chapter 4. The origins of private telegraphy

> A Private Telegraph. The union of these two expressions would have seemed absurd less than ten years ago, and why? The fact is, we have regarded telegraphs as public institutions of necessity. We thought it might be well enough for companies to have their lines, charging a certain sum for messages which they convey; we thought that even Government might have exclusive lines; but private individuals to have their private lines of telegraph was surely far beyond the bounds of reason.[273]

Telegrams, as we saw in the previous chapter, were firmly embedded in Victorian society by the end of the 1860s. They were an alternative to letters, especially for inter-urban communication, and the rivalry between these two forms of written communication strengthened the case for the nationalisation of the telegraph industry. This journey into public telegraphy sets the scene for the present chapter, which offers a contrasted view of telegraphy: here, I examine the origins of private telegraphy and its early stage of domestication.

On 26 November 1859, Charles Dickens published the thirty first issue of his *All The Year Around* magazine. As ever interested in new developments in science and other matters of interest to his readership, he often published non-fiction articles, and this issue was no exception. This time, Dickens had chosen the topic of the electric telegraph, and more precisely the novel project of LDTC: a network of metropolitan district stations connected via telegraphic wires stretched above houses (more on this project later in this chapter). In the words of Dickens, 'it was the first time the proposition to electrify

[273] Anon, 'Private Telegraphy', 2. Established in 1864, *The Telegraphic Journal* provided a weekly report of electrical progress, representing every interest in telegraphy. It is significant that in its first publication, the journal's first article (from which this epigraph was extracted) discusses private telegraphy. We learn from it that by the mid-1850s public telegraphy had become a 'public institution of necessity', and the idea of a domestic telegraph would have been then unthinkable, that is until 1857, as will be seen in this chapter.

all London was brought before the British householder'.[274] One year later, many more telegraphic wires were strung over house-tops and some of these wires were even brought directly into households by the undertaking of UPTC. This was the first time information was transported via the medium of electricity along the streets and into offices and households. In this case, the electric current carried messages rather than power for electric lighting, but there were similarities between telegraphy and the electrification of the household which occurred later during the late Victorian and Edwardian periods. Like electric lighting, the electric telegraph required the construction of an infrastructure – the private wires – as a pre-condition for its operation. Also like electric lighting, there was a technological transposition from its public to its private incarnation. Because of this transposition, private telegraphy inherited the perceived threats from its public counterpart and these threats had to be mitigated for the domestication process to be successful. Some of these perceived threats were illustrated in *Chambers's Journal* on 26 December 1863, in an anecdotal article that told of a housewife who had been terrified of opening telegrams for fear of receiving bad news about her husband, and of a gentleman who had 'seriously' requested a telegraph clerk to send two dozen stamps to his wife in the country.[275] As Gooday pointed out, the domestication process requires the technology to be unthreatening and meaningful to the household economy of values and, as these two anecdotes demonstrate, this was

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[274] Dickens, 'House-Top Telegraphs', 106. Dickens also describes with humour the various reactions of householders along the path of the electric wires – ranging from hostility, to hesitation or even fear, and enthusiastic endorsement of the technology.

[275] Anon, 'The Domestic Telegraph', *Chambers's Journal of Popular Literature, Science and Arts*, 26 December 1863.

clearly not the case with public telegraphy in the early 1860s.[276] Furthermore, in the case of private telegraphy it was not the risk posed by electricity that had to be mitigated, nor was it a question of aesthetics, it was the usability or user-friendliness of the instruments brought into offices and households that mattered most. I show in this chapter how such prejudices, misconceptions and challenges were overcome.

Unlike its public counterpart, private telegraphy required customers to operate the instruments, and the taming of such devices was a critical success factor. In Chapter 3, I revealed that as early as 1837 Wheatstone had the vision of a domesticated instrument – one that could be operated by any literate person with little or no prior formal training in telegraphic communication. In this chapter, I describe how Wheatstone's vision became a reality, and how he overcame the technical challenges of private telegraphy.

The chapter is divided into four sections. In the first section, titled '**a business want for a ubiquitous telegraph'**, I provide evidence that private telegraphy emerged in 1857 from a want for a more direct and immediate form of telegraphic communication, which evolved independently from public telegraphy.[277] This want revived the development of the step-by-step technology (the precursor of the ABC instrument) which, as seen in

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[276] Gooday, *Domesticating Electricity: Expertise, Uncertainty, and Gender 1880-1914*, 3.

[277] I use deliberately the term 'want' instead of 'need', while recognising that the former has somewhat fallen into disuse in modern days, the latter is often used interchangeably to mean both necessity and desire. In the introduction of Chapter 3, I stated that there was no need for an electric telegraph: a subjective, fictional need (a want, in reality) for telegrams (public telegraphy) was created *a posteriori* by a technology push (a pattern frequently repeated in the consumerist society in which we live today). However, as we shall see later in this chapter the case of private telegraphy was altogether different: here, it was a desire to solve a challenge (that is, making police communications more efficient) that created a demand for private telegraphy.

Chapter 3, was stifled by Cooke following his agreement with Wheatstone in 1845. The evidence takes the form of two projects, launched respectively in 1857 and 1859. Both reflected a want for a more ubiquitous telegraph, and both pioneered private telegraphy, albeit with varying degree of success. First, I describe the undertaking carried out by the firm of Waterlow & Sons, the London-based printers, lithographers and stationers, and I reveal the critical role played by Sydney Waterlow, one of the directors of this company.[278] Next, I show how LDTC, the company that Dickens wrote about, attempted to provide a more ubiquitous telegraphic system.

The second section deals with '**the commercialisation of private telegraphy'**. It provides a comprehensive history of UPTC – the telegraph company that championed private telegraphy – from its inception in 1860 to 1868, just before its appropriation by the Post Office, an event which is examined in Chapter 5. UPTC was Wheatstone's project. It was formed to provide private telegraphy to customers in metropolitan areas, using ABC instruments and private wires. I describe the way it operated, and how, with its unique business model, the company succeeded in responding to the want for a more direct and immediate form of telegraphic communication in urban environments, when other companies had failed to provide a viable alternative to the district postal services.

Early adopters were instrumental in shaping the technology, and in '**the wide appeal of private telegraphy'**, the third section of this chapter, I provide an insight into why and how local public services, like police authorities, and firms in the printing,

[278] Waterlow & Sons' assets were eventually acquired by Purnell & Sons and De La Rue in 1961. Unfortunately, the archives from the company have apparently been lost: Arthur Geary, Consultant Archivist at De La Rue, indicated on 5 November 2013 that it is alleged that these archives were sold off to reduce their debt prior to the take-over of the company.

publishing and media sectors, pioneered private telegraphy. The way customers perceived, appropriated and gradually embedded the technology into work practices and everyday life is explored, and I reveal how these users gave meaning and status to the technology, how they influenced its development, and how they were influenced by it. Such a development, I conclude, was driven by both the producer and the consumer of this technology, in a collaborative construction process that reinforced the distinctiveness of this branch of telegraphy.

The fourth section is '**an international perspective on private telegraphy'**. Here, I explore private telegraphy in two other countries in order to establish a comparison for the events taking place in Britain. This is not an exhaustive international study, as only France and the USA are considered, but I provide ample evidence for demonstrating that the definition of private telegraphy varied from country to country, and for establishing that Britain was amongst the first, if not the first country in the world to implement on a large scale the concept of private telegraphy *stricto sensu*.

I will shortly examine the want for private telegraphy, but before engaging in this discussion it is worth remembering that the development of the dial instrument had been halted in 1845 as a result of the dispute between Cooke and Wheatstone. We saw in Chapter 3 that the step-by-step technology, the precursor of the ABC instrument, was Wheatstone's most important contribution to the joint patent of 1840. The fact that he retained ownership of this technology following the arbitration procedure was a major concern for Cooke, because elements of Wheatstone's designs were incorporated into his needle instrument that was also specified in the patent. An agreement was finally reached in 1845 to assign exclusive rights (in Britain) to Cooke for the joint patent of 1840, in return for a significant financial compensation for Wheatstone. However, Cooke was only interested in the needle technology. The dial instrument was therefore ignored and its concept remained dormant until a want for an instrument fit for domestic use emerged in 1857. It is to this societal want that our attention will now turn.

Figure 4.1. Charles Wheatstone's original 1840 dial instrument (Patent No. 8345), based on the step-by-step technology: the 'Communicator' on the left, and the 'Indicator' on the right (battery not shown). See Appendix 4 for a full history of the step-by-step technology and the ABC instrument. Photographed at Blythe House in September 2013, and reproduced with the kind permission of the Science Museum London.

4.1. A business want for a ubiquitous telegraph

By the late 1850s, telegrams had become an accepted means of long-distance (inter-urban) communication by professionals.[279] However, there was no direct communication with the recipients, and telegrams had first to be transcribed at the telegraph stations before being carried to their final destinations by messenger boys. In this section, I examine two projects, launched respectively in 1857 and 1859. Both reflected a want for a more direct and ubiquitous form of telegraphic communication, and both pioneered private telegraphy, albeit with varying degree of success.

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[279] See figure 3.2. Telegrams were also used, but to a much lesser extent, for domestic and social use by the wealthy classes.

The first undertaking took place in 1857. It was carried out by the firm Waterlow & Sons, the London-based printers, lithographers and stationers. They were the first organisation to recognise the potential benefits of private wires. This project is the earliest recorded use of private telegraphy outside the railway industry and the first operational network of this kind in the country, and possibly the world (see section four of the present chapter). It is interesting to note, however, that five years earlier, in 1852, the Bank of England had planned a system of electric telegraphs to communicate with its branches, as well as from branch to branch, but the proposal made by UKTC was rejected in 1853.[280]

Waterlow & Sons was established in 1844 by Sydney Hedley Waterlow (later Lord Mayor and Sir Sydney Waterlow) as a small printing office.[281] Later that same year, James Waterlow, Sydney's father, and his brothers Alfred, Walter and Albert, joined the firm.[282] By the end of the century the partnership had become a significant and very successful business, employing in excess of 4,000 workers in ten establishments. Waterlow & Sons printed magazines, including the Banker's Magazine, Banking

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[280] We saw in Chapter 3 that UKTC was first established in 1851 by Thomas Allan, with Wheatstone as a scientific advisor, and the company originally intended to provide private wires. The system proposed to the Bank of England, according to Highton, employed the single-needle instrument patented in 1851 by George Edward Dering, who was also involved with the Electric Telegraph Company of Ireland at the time. 'Committee of Treasury Minutes' (Bank of England, 29 September 1852), 228, http://www.bankofengland.co.uk/archive/Pages/digitalcontent/archivedocs/treasuryminutes/18261850.aspx. 'Committee of Treasury Minutes' (Bank of England, 18 May 1853), 21, http://www.bankofengland.co.uk/archive/Pages/digitalcontent/archivedocs/treasuryminutes/18511875.aspx. Edward Highton, *The Electric Telegraph: Its History and Progress* (London: John Weale, 1852), 155.

[281] George Smalley, *The Life of Sir Sydney H. Waterlow* (London: Edward Arnold, 1909), 29.

[282] The Post Office Directory for London listed the company as 'Waterlow James & Sons' law stationers, letterpress and lithographic printers. Anon, *Post Office Directory of London* (London: Kelly & Co, 1852), 1049.

Almanac, the Solicitor's Diary and many other books on law. They printed paper money for home and colonial banks, and even foreign governments. They also supplied postage stamps and postcards, and a range of commercial stationery such as account books and envelopes, as well as tickets for the railway industry, and produced commercial engraving (seals and medals), lithography and engrossment of deeds.

Waterlow & Sons' registered office was at 26-27 Great Winchester Street in the City. Two other establishments were close by: the retail department for general stationery was just around the corner at 65 to 68 London Wall, while the works were in Finsbury Square and 24 Birchin Lane, a few blocks away. For the convenience of their law-making and government customers, a stationery shop had also been established nearly three miles away at 49 Parliament Street in Westminster which, according to the 1851 census, was the residence of Walter Waterlow (Law Stationer) and his wife Rebecca.

In 1857, Sydney Waterlow, by then a well-known and respected businessman in the City, was asked to fill a recently vacated common councilman position in the Broad Street Ward. As a common councilman he became interested in the operation of the City Police, and was soon convinced that an improvement in communication between the police stations and the Commissioner's office would improve its efficiency.[283] It occurred to him that the electric telegraph could achieve this aim, but telegraphy in those days was solely a long-distance, inter-urban communication service, and he

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[283] Sir Sydney H. Waterlow became an Alderman in 1863; he was appointed Lord Mayor in 1872 and was granted the dignity of a Baronet in 1873. It should be noted that an article in *The Times*, dated 1 September 1857, mentioned that Charles Wheatstone and Edwin Chadwick had also advocated the (police) plan some years before.

needed first to demonstrate the technical feasibility and economic viability of a metropolitan telegraphic network. To this end, having enrolled his business partners – his father and brothers – he embarked on a project that transformed the perception of telegraphy, from a 'public institution of necessity' to a better, quicker, and private form of interpersonal communication.

The project involved the establishment of a telegraphic network between Waterlow & Sons' establishments in London Wall, Birchin Lane and Parliament Street. The main difficulty was the laying of the private wires. The high cost of running wires underground just between London Wall and Birchin Lane, initially estimated at £1,200, forced Sydney Waterlow to look at alternative solutions – an aerial infrastructure over house-tops soon becoming the obvious choice.

With the help of Messrs Allen and Rowland, he proceeded to deploy this innovative aerial wiring infrastructure.[284] Allen was a builder who, for the purpose of this project, invented a cast-iron saddle for receiving the masts upon which were strung the electric wires; and Rowland had previously helped Cooke install telegraphs at the South Western Railway in 1845.[285] The wires extended from London Wall to Birchin Lane across Cornhill, Throgmorton and Broad streets, a distance of almost 1,500 feet, and from there to Parliament Street. The laying of the line to Parliament Street was the most challenging task: from Birchin Lane it went along to Cannon Street, down to Upper

[284] Overhead wires erected on poles alongside railway tracks, canals and roads were then common in public telegraphy as part of wayleaves, but none (at least in Britain) had yet been employed in an urban setting.

[285] 'Over-House Telegraphs', *Daily News*, 18 August 1857, 2.

Thames Street, crossing the Thames a first time on Southwark Bridge, going alongside this bank of the river and then crossed it again at Hungerford Bridge to reach Parliament Street (see Figure 4.2. below).[286] The wires, slightly larger than a common bell wire, were made of steel for strength and lightness, and although only one wire was needed, two wires were installed in anticipation of future use. The overall cost for deploying the infrastructure, including the supporting poles, saddles, insulators and labour, amounted to £50 per mile, plus an additional £4 per mile for protecting the wires with an oil-based paint, as needed.[287] This was a vastly more economical solution than underground wires.

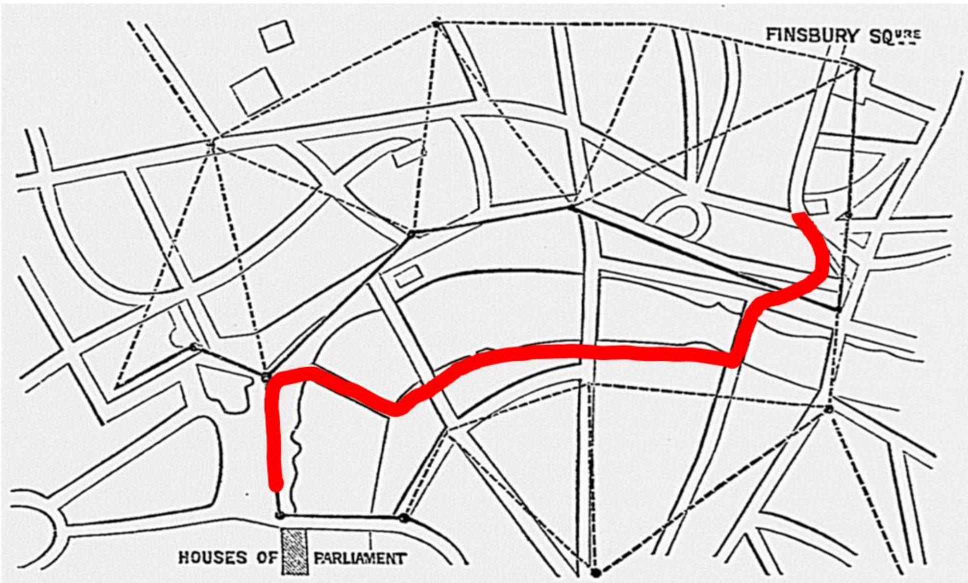

Figure 4.2. Waterlow's private network (1857) from London Wall to Parliament Street, via the Southwark and Hungerford bridges: an approximate path (thick red line) has been overlayed on a map of London published in an article titled 'The nervous system of the metropolis' on 2 March 1861 in the magazine *Once A Week*. The other plain and dotted lines represent the intended route of the future UPTC network (see Figure 4.5.).

[286] WM. Hylton Jolliffe and Barnett Blake, 'Overhouse Telegraphs', *Journal of the Society of Arts* 6, no. 299 (13 August 1858): 586.

[287] The original estimation, according to John Durham who had accessed the private papers of the company (which have since been lost following the acquisition by De La Rue) was £35 to £45 for the 450 yards between the two sites. John Durham, *Telegraphs in Victorian London* (Cambridge: The Golden Head Press, 1959), 3.

Obtaining permission from landlords and occupiers to string the wires over the house-tops was achieved rapidly.[288] In only one instance an owner dissented: the Drapers' Company objected to the passage of the wires, even though no mast was to be affixed on their roof, arguing that they had 'a freehold from the centre of the earth to the canopy of heaven'.[289] Eventually, they agreed to let the wire pass over their roof for the price of half a crown a year. Apart from this episode, there were also instances when the requirement for a joint assent caused delays. Generally though, the written agreement proposed by Waterlow & Sons, which guaranteed the owners the prompt removal of the poles and wires at short notice and the repairing of any damage caused by the installation, seems to have alleviated the doubts of most landlords.

The type of telegraph chosen for this project was the single-needle instrument, widely employed in public and railway telegraphy. This was a simple device, but it required a skilled operator to transmit and receive the messages. It was also relatively inexpensive, with a unit cost £5.[290]

As can be seen in the following advertisement, an important part of Waterlow & Sons business was with central and local governments, and a general election was both a business opportunity and a production challenge because it required a fast turnaround for printed material.

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[288] The rapidity with which permissions were obtained probably reflected the novelty of private telegraphy at this time. More resistance was met as the novelty wore off.

[289] Smalley, *The Life of Sir Sydney H. Waterlow*, 40.

[290] The separate cost of the associated alarm was about £4.

> Circulars, Cards, Posting Bills, &c, &c. printed and distributed in the shortest possible time. 5,000 or 10,000 circulars can be prepared, the envelopes addressed to the respective Electors, folded and despatched, within 24 hours.[291]

This private telegraph network enabled the firm to transmit production orders and other business transactions from one establishment to another in a much shorter time than a messenger boy would have taken.

With this project, Sydney Waterlow had pioneered private telegraphy, and demonstrated its affordability and practicality when associated with aerial wires. This achievement was widely reported by London and provincial newspapers in July and August 1857, and many articles made reference to Waterlow's proposal for interconnecting the stations of the City Police with a similar system. As the *Daily News* stated on 17 August 1857, 'the importance of such a rapid communication can scarcely be over-estimated, and the amount spent at present in communications between the police-stations alone must far exceed the interest of such an outlay.' However, Daniel Whittle Harvey, the Chief Commissioner of Police, was reluctant to accept the proposal because the public could have accessed the wires too easily where they ran over rooftops, and it was only after the proposal was changed to specify that the wires were to be attached to church belfries instead of rooftops that the project was finally accepted. *The Times* reported on 4 March 1858 that the police committee of the City of London had accepted the latest proposal from Sydney Waterlow, seven months after Waterlow & Sons had started the operation of their private network.

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[291] 'General Election', *Morning Post*, 18 March 1857, 1.

UPTC, as we shall see shortly, did not start its operation until 1860, and although Smalley indicated that the three initial telegraphs used by Waterlow & Sons were Wheatstone's instruments, we can only speculate about the contacts that may have taken place between Wheatstone and Messrs Waterlow between 1857 and 1860.[292] However, doubtless the Waterlow & Sons undertaking had drawn the attention of Wheatstone because he resumed work on his original dial instrument, the technology that had been left dormant for more than a decade. Indeed, by 1857 the 1840 patent and the terms of his 1845 settlement with Cooke had expired and he was free to develop further the step-by-step technology without fear of infringing upon Cooke's rights. In his patent of 1858, Wheatstone described the first model of the ABC instrument, and his patent of 1860 improved it further.[293] But Sydney Waterlow had also demonstrated that a house-top infrastructure was the most practical way of creating a telegraphic network in an urban environment, even though it was mono-tenant – therefore lacking scalability. Wheatstone seems to have responded to this challenge because his patent of 1860 specified the design of a cost-effective multi-tenant aerial cabling system specifically intended for private wires.[294] It would indeed be a strange coincidence if the resumption of his work was not connected to the Waterlow & Sons undertaking. Considering his business acumen, it seems logical that, comforted in the knowledge that his vision of a domestic telegraph was becoming a reality, he embarked on a business

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[292] Smalley, *The Life of Sir Sydney H. Waterlow*, 41.

[293] In the 1860 version of the ABC instrument, the rotary dial became more sophisticated and easier to use. See Appendix 4 for further details.

[294] At least one newspaper reported that the aerial wiring technique had been suggested to Wheatstone by Mr Sydney Waterlow. 'The Universal Private Telegraph Company and Mr Julius Reuter's Establishments', *Glasgow Herald*, 10 August 1861, 3.

venture – one that would be decisive for the future of private telegraphy – the incorporation of UPTC, as will be seen in the next section.

Before turning our attention to the second project, however, it is worthwhile to mention an article from the *Daily News* on 9 November 1860 about the status of the City Police project. At this point in the chronology, the Court of Common Council had approved a budget of £600 and the installation of this private network was progressing rapidly using the steeples of churches to attach the wires, as the consent of the churchwardens had been obtained without difficulty. The police superintendent, Captain Hodgson, had also tested three types of instrument to ensure that the inspectors working the lines would be comfortable with their operation – these instruments were the single- and double-needle instruments, a Morse's recorder instrument and Wheatstone's dial telegraph. Despite its higher price, Wheatstone's instrument was selected for its ease of operation and the fact that it did not incur the additional expense of hiring skilled operators, as with the needle or Morse instruments.

The want for a more immediate and ubiquitous form of telegraphic communication during this period was also reflected, in 1859, by the establishment of LDTC, a new public telegraph company that brought the telegram service closer to customers via a network of district stations across London. In contrast to LDTC, ETC expected customers to visit their central office, where they wrote down their messages on a half-sheet of paper, handed them to a clerk for transmission, and were (at the time) charged per word and according to distance, ranging from 3 $^{9/10}$ d. for Birmingham to 8

$^{2/3}$ d. for Glasgow, inclusive of 'porterage or cab hire'.[295] LDTC was formed for the purpose of conveying messages around London. The original intent had been to deliver messages of up to ten words to any place within a radius of four miles from Charing Cross at a cost of 4d., but the tariff was later set at 6d. for fifteen words, excluding the address.[296] Initially located within the offices of the British and Irish Magnetic Telegraph Company (MTC) in Threadneedle Street, LDTC eventually relocated their premises to Cannon Street in 1860.[297]

The company created a three-tiered network: a central office connected to district-based communication hubs which, in turn, were linked to local stations.[298] Originally, LDTC had intended to run the wires underground but despite the gutta-percha insulation, the frequency of failures was too high. Inspired by the Waterlow project, an aerial topology was adopted, where appropriate. As can be seen from the

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[295] Bond, *Stokers and Pokers, or the London and North Western Railway - The Electric Telegraph and the Railway Clearing House*, 113. It is interesting to note that porterage involved the employment of boys, initially paid weekly wages of about 4s. per week, before the system was changed to piece-work, at one penny per message, to improve the quality of the service. Andrew Wynter, 'The Nervous System of the Metropolis - Part 2', *Once a Week - An Illustrated Miscellany of Literature, Art, Science, & Popular Information*, 16 March 1861.

[296] 'District Proposal', *Standard*, 7 December 1858, 2.

[297] The relationship between LDTC and the British and Irish Magnetic Telegraph Company was mutually beneficial, with LDTC offering their customers the option of sending a long distance telegram via BIMTC's inter-urban network, while BIMTC used LDTC's capillary network of stations as a collector of messages.

[298] In 1850, an eminent French engineer called Aristide Dumont proposed to install in Paris a similar telegraphic system, but even more ambitious. The architecture was based on three layers: a central telegraph office station, secondary (district) stations and private wires going to subscribers (who could communicate with each other). The scheme was referred to as "la petite poste électrique". It was never implemented as considered too avant-garde. Moigno, *Traité de Télégraphie Electrique, renfermant son Histoire, sa Théorie et la Description des Appareils*, 578. Anon, *Biographie Nationale Des Contemporains* (Paris: Glaeser & Cie, 1878), 214. 'Société Universelle Pour l'Encouragement Des Arts et de l'Industrie', 6, June 1855, 91, BNF.

following quote, LDTC's decision to adopt such a topology was advertised as a cost effective alternative to underground cabling:

> An undertaking is about to be introduced for the purpose of providing the various localities in the immediate neighbourhood of the metropolis with the means of telegraphic communication. The construction, so far as practicable, will be by the inexpensive over-house system adopted in Paris, New York, and Brussels, and lately in London by Messrs Waterlow & Sons.[299]

By the end of 1863, one hundred and fifty miles of wire had been installed, two-thirds of them over house-tops, and eighty-three local stations had been established.[300] According to Dickens, every mile of wire required a minimum of six house-tops, each one rented at a shilling a year with a three-month notice period for removal. Negotiations with householders and landlords were notoriously laborious, but by and large no major difficulties were encountered to establish the network, although not everyone appreciated the transformation of the urban landscape as revealed by this excerpt of an essay published 9 January 1864:

> What with ugly Railway Bridges disfiguring our streets and Electric Wires like clothes-lines carried along our house-tops, we Londoners have certainly very few prospects to be proud of.[301]

The reference to 'clothes-lines', above, seems to have been inspired by an earlier illustration by the caricaturist John Leech published two years earlier, and which showed the growing number of telegraphic wires on house-tops:

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[299] 'The London District Telegraph Company', *The Illustrated London News*, 11 December 1858, 556.

[300] Anon, 'The Domestic Telegraph', *The Telegraphic Journal: A Weekly Record of Electrical Progress*, 7 May 1864, 219.

[301] Anon, 'Paint-Pot Advertisements', *Punch, or the London Charivari* 46, no. 1174 (9 January 1864): 19.

POSITIVE FACT, OF COURSE.

A MESSAGE COMES OFF ON MRS. BLUEBAG'S LINEN, WHICH SHE IS HANGING, AS USUAL, ON THE TELEGRAPH WIRES.

Figure 4.3. An early depiction of the impact of house-top telegraphic wires on the urban landscape. This is in reference to the LDTC network.[302]

Because of the star-like configuration, messages sent from one station to another had to go via the central station where female clerks were employed to work the instruments.[303] When such a message arrived in Cannon Street, it was first transcribed on a piece of paper, and then handed over to the clerk working the instrument connected to the destination station for retransmission. At the receiving end, a hard copy of the message was then given to a boy for delivery to the final destination. For the most part, LDTC used district post offices or tradesmen to set-up the local stations, which usually employed only one clerk. The stations were, in principle, no more than a

[302] John Leech, 'Positive Fact, of Course', *Punch's Almanack* 42 (1862): 5. The caption says: 'A message comes off on Mrs Bluebag's linen, which she is hanging, as usual, on the telegraph wires'.

[303] The original idea of using the district hubs for collecting and re-distributing local messages was not implemented at the time.

five minute walk from customers, and LDTC claimed they could deliver messages within half-an-hour of their receipt at the originating station.

LDTC served the needs both of businesses, typically the local trading community, and individuals for domestic and social purposes.[304] Achieving sustained profitability, however, proved elusive, although there was an encouraging growth of the business in the first few years. Following a peak of activities in 1865, the number of messages gradually declined.[305]

Despite teething problems, LDTC enjoyed a good reputation in the early 1860s, especially with business customers.[306] Some issues remained about the quality of the service. Besides the occasional operator mistakes during the decoding process (typically associated with needle instruments), there were transcription errors during the transit of messages at the central office. There were also issues with delivery boys who sometimes went to the wrong address, lost the message or took too long to deliver it. Delays could also be caused as a consequence of the wires being engaged, as these were shared amongst customers.

Wiring problems were common because LDTC used two suspended parallel wires: the noises generated by the wind blowing against the aerial wires could be a nuisance to the public; the rain or the wind could also bring the two wires into contact, causing

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[304] Tradesmen were offered a special rate of 20 shillings for 100 messages.

[305] From 73,480 messages transmitted in 1860, LDTC transmitted 251,548 messages in 1862, which according to Mr Taylor, its chairman, represented upwards of 700 messages daily. 'London District Telegraph', *The Times*, 3 March 1862, 6.

[306] In the Town Telegraphs article quoted below, reference is made to public advertisements by Mr Chubb notifying that 'in case any person should have left the key to his safe or desk at home, by telegraphing to him he will send a duplicate to any address.'

the messages to be received by the wrong station; solar flares could create magnetic disturbance, such as the powerful event recorded by the Kew Observatory and by other observatories throughout Europe, America and Australia between 28 August and 7 September 1859 which interrupted telegraphic communication; lightning strikes could disrupt the whole operation by temporarily demagnetising the instruments' needles, as happened with the severe storm of September 1863 which brought down fifteen stations.[307]

The decline of the business, especially after 1865, was due to in a large part to the increasing presence of UPTC which had a far better product and operating model for addressing the needs of business customers, as will be seen below. LDTC attempted to counter UPTC with its own private wire offer, but even contemporary commentators did not believe they could succeed, as they believed that LDTC lacked an economically viable and scalable aerial cabling system, such as the one patented by Wheatstone in 1860.[308]

Nevertheless, a few private networks were sold by LDTC: in 1862, for instance, the London Fire Brigade was provided with a private telegraphic communication system that connected the foremen's stations in various districts to the Chief's station, using alphabetical dial instruments made by Messrs Siemens & Halske.[309] Too often, the old

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[307] Anon, 'The Domestic Telegraph', 7 May 1864, 220. Balfour Stewart, 'On the Great Magnetic Disturbance of August 28 to September 7, 1859, as Recorded by Photography at the Kew Observatory', *Proceedings of the Royal Society of London* 11 (1 January 1860): 409.

[308] Anon, 'Town Telegraphs', *The London Review of Politics, Society, Literature, Art, and Science* 6, no. 148 (2 May 1863): 462. *The Times* reported on 3 March 1862 that LDTC income derived from private wires was £1,000, and the capital expended to secure that sum amounted to £3,000.

[309] Anon, 'The Fire Brigade Telegraph', *The Telegraphic Journal: A Weekly Record of Electrical Progress* 1, no. 4 (23 January 1864): 37–38.

alarm bell system had created momentary panic for the entire brigade for events which turned out to be of little importance. The alarms raised with the new telegraphic system were descriptive, which improved significantly the efficiency and effectiveness of the operation by mobilising the right amount of resources in the shortest possible time.

In any event, private wires were a subsidiary business for LDTC, and this activity was further impeded by Article 41 of the Telegraph Act, 1863 which stipulated that, unless the wires were private, 'every telegraph of the company shall be open for the messages of all persons alike, without favour or preference'.[310] In effect, this article prevented LDTC from giving priority of communication to private customers on existing shared lines, and the company had only two options: treat private communication as normal traffic or install new wires for private customers at great expense, which was, of course, economically unsustainable. LDTC eventually changed its name to the London and Provincial Telegraph Company in 1867 in an attempt to extend its market beyond London, but its assets were soon after acquired by the General Post Office.

Nonetheless, the launch of LDTC in 1859 reflected a want for a more ubiquitous telegraph: they brought the telegraph closer to the public with the creation of district stations and even offered private wires, although the latter endeavour was rash and unsuccessful. As mentioned by the *Daily News* on 9 September 1860, the sight of Waterlow & Sons' electric wires crossing the river and several of the main thoroughfares of the metropolis had not only gradually wrought a change in the public mind, it had also inspired LDTC in carrying the electric wires over house-tops. By simply imitating

[310] 'An Act to Regulate the Exercise of Powers under Special Acts for the Construction and Maintenance of Telegraphs (Telegraph Act, 1863)', 28 July 1863, 26 & 27 Vic. Cap. 112.

Waterlow's aerial wiring approach, however, LDTC failed to take into account its lack of economies of scale. Waterlow's house-top solution was designed for a single user, LDTC needed a multi-tenant system. Still, the visibility of LDTC's urban telegraphy undertaking must surely have helped the introduction of UPTC, to which our attention will now turn.

4.2. The commercialisation of private telegraphy

The first entry in the UPTC ledger is dated 6 June 1861, the day before the company was incorporated through a Private Act which specified a capital of £190,000 and authorised the provision and maintenance of 'private telegraphic communication for public offices and counting houses, railway, police, fire and engine stations, banks, docks, manufactories, warehouses and other establishments'.[311] The ledger entry refers to the purchase of 47 telegraph sets from Augustus Stroh (a set being a communicator, an indicator and a bell), for customers awaiting delivery. Indeed, Wheatstone and his associates promoted private telegraphy long before the company was formed, even before the 1860 patent was granted, as revealed by an article published in the *Glasgow Herald* on 10 April 1860 which stated that 'in its present state the telegraph is decidedly not a people's telegraph, messages require to be handed over to a paid clerk and all idea of privacy is out of the question'. The article went on to endorse enthusiastically the private use of telegraphy and praised the beauty and simplicity of Wheatstone's instrument. As early as October 1860, UPTC advertised its services in newspapers, and

[311] 'UPTC Ledger 1861-1865' , TGJ/2/1/1, BT Archives. 'An Act for Incorporating the Universal Private Telegraph Company, and to Enable the Said Company to Work Certain Letters Patent', 7 June 1861, 24 & 25 Vic. Cap. 61.

from these promotional campaigns we learn that, in the metropolis, private wires had been ordered by the London Docks, the Houses of Parliament and Messrs De La Rue.

A host of influential parties accompanied Wheatstone in the venture: William Fairbairn, the eminent engineer and shipbuilder from Manchester, James Walker, the Scottish-born distinguished engineer and builder of docks, lighthouses and canals, and John Peter Gassiot, a wealthy businessman and enthusiastic supporter of electrical experiments, all directors of the company and Fellows of the Royal Society.[312] On the operational side of the company Wheatstone's associates were Nathaniel Holmes, the electrical engineer of the company who was known for his work on long distance telegraphy (later replaced by Colin Brodie who first came on the payroll in January 1862 as his assistant), and the publicity-shy Augustus Stroh, the German-born (later a naturalised British subject) clock-maker who came to London to see the Great Exhibition in 1851, and stayed to work with Wheatstone.[313] In 1860, Stroh worked with Wheatstone to produce the instruments, independently at first, and then as the engineer of the British Telegraph Manufactory company, which became the main production facility for the ABC instruments and other telegraph equipment sold by UPTC.[314] For its operation, UPTC had also secured the services of two companies which later became important shareholders: Silver & Co produced the thin wires, which were

[312] 'The Universal Private Telegraph Company and Our City Telegraphs', *Glasgow Herald*, 11 October 1860, 2.

[313] Anon, 'Obituary Notices (John Matthias Augustus Stroh)', *Journal of the Institution of Electrical Engineers* 53, no. 250 (15 June 1915): 871.

[314] Like Wheatstone, Stroh was also a musical instrument maker. He is perhaps best known for the design of the Stroh Violin which incorporates a horn into a violin to produce a stronger and more directional sound.

individually insulated with an India-rubber process and further protected by narrow strips of tape and hemp, before being bundled together into cables (ropes) of up to 100 wires; and the Reid Brothers who were responsible for the fittings, namely the installation and maintenance of the wires and instruments.[315]

A significant portion of the capital of the company came from Manchester and it was in that city, under the auspices of Fairbairn, that UPTC signed up its first customer outside London: a visit by Holmes in October 1860 led to a contract with the Platt Brothers in Oldham.[316] This was an important machinery manufacturer employing about 5,000 people in two factories, one and a half miles apart. A private wire, locally manufactured by the Johnson Brothers (a supplier of wire to the telegraph industry, including submarine cables) was installed between the two sites to connect the ABC instruments.

On 21 December 1860, we find Holmes back in London, demonstrating Wheatstone's telegraphic instruments, both the ABC and the automated printer (often referred to as Wheatstone Automatic), at a promotional event organised in the premises of Julius Reuter in Finsbury Square, just a stone's throw away from one of the offices of Waterlow & Sons.[317] Reuter's telegrams were known to the public through the daily press, and the rapid retransmission of these despatches to the newsrooms of the London newspapers was of prime concern to Reuter as the value of such news, which

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[315] Silver & Co started as a clothier and outfitter, before opening the India Rubber Works and Telegraph Cable Company. Following acquisition of the Gutta Percha Company, they became the India Rubber, Gutta Percha and Telegraph Works Company. Jonathan Mellor, one of the directors of the company, was later appointed chairman of UPTC.

[316] 'The Electric Telegraph at Oldham', *Daily News*, 27 December 1860, 7.

[317] 'Private Telegraphs', *Morning Post*, 22 December 1860, 6.

was mostly of an economic or political nature, diminished over time. The subsequent order from Reuter was significant as it involved creating private channels of communication with newspapers. *The Times*, *Daily Telegraph* and *Morning Star* were amongst the first newspapers to benefit from this rapid forwarding of telegrams, but the competitive advantage afforded by these private wires was short lived because all the London dailies were eventually connected to *Reuters'* offices in Waterloo Place, Cornhill or Finsbury Square.[318]

[318] In addition to these private communication channels to Reuters, several newspapers used private wires to connect their offices with the reporters' gallery in the House of Commons. 'Transfer of Electric Telegraphs to the Government', *The Times*, 3 September 1867, 4. And, as early as October 1861, the *Daily Telegraph* had also commissioned private wires to connect their office in Fleet Street to the residence of their owner, Joseph Moses Levy, in Russell Square. 'Colin Brodie Papers, 1862-1871', TGJ/1/4, BT Archives. See also: 'District Private Telegraphs', *Sheffield and Rotherham Independent*, 13 September 1865, 3.

Figure 4.4. Charles Wheatstone's ABC instrument, based on the 1860 specification (Patent No. 2462) and further improved (c. 1865) by combining the Communicator and Indicator into a single instrument, together with a magneto-electric generator to avoid battery operation. This instrument is stamped GPO. Photographed at Blythe House in September 2013, and reproduced with the kind permission of the Science Museum.[319]

An indenture between Wheatstone and UPTC, dated 7 August 1861, established the financial arrangement between the parties. Wheatstone was allocated 680 shares of £25, a total of £17,000, for the transfer of patents 1241 and 2462 to UPTC, giving exclusivity to the company for the UK only. The transfer of patent number 1239 (Automatic Printing Telegraph) was dealt with in a second indenture on 10 August 1864,

[319] Questioned during the arbitration proceedings that began on 30 April 1869, Colin Brodie mentioned that in 1865 UPTC began a substitution of existing ABC instruments by a better class of ABC instruments. In file XV: 'Purchase by the Post Office of the Universal Private Telegraph Company - Part 1'.

which allocated a further 400 shares of £25 (a total of £10,000) to Wheatstone. The agreement also specified that £2,700 (108 shares) was to be paid to Wheatstone for every 652 called up shares (£16,300). These arrangements also authorised UPTC to manufacture and supply the instruments, against the payment of royalties for rental (one pound per year for five years) as well as for the sale of such instruments (five pounds).[320] All in all, this was a rather profitable arrangement for Wheatstone, again proving his shrewdness when it came to business transactions.[321]

Wheatstone was the largest shareholder of the company with 566 shares.[322] Amongst the hundreds of other shareholders were Baron Hermann de Stern, David Salomons (Alderman, MP – the first chairman of UPTC), Dr Edward Frankland FRS, and other directors like William Fairbairn FRS, Frederick Gaussen and John Peter Gassiott; the Reid Brothers bought a significant number of shares, so did Silver & Co, and later Jonathan Mellor, UPTC's second chairman. The social reformer Edwin Chadwick held 32 shares of the company. The capital injected into the company and the prominence of many of its shareholders enabled it to move forward at a brisk pace.

Less than a month after the first indenture, on 3 September 1861, UPTC finalised a deal with ETC.[323] As part of this exclusive seven year agreement, UPTC customers were

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[320] The actual amount was calculated to be equal to half of the gross profit: the selling price to the purchaser, less seven and a half per cent for commission and other expenses, minus the cost of manufacture divided by two.

[321] 'Contracts between Charles Wheatstone and the Universal Private Telegraph Company (in Folder: Purchase by the Post Office of the Universal Private Telegraph Company, Part 1, 1864-1870)', Post 30/311B, BT Archives.

[322] 'UPTC Seal Register and Dividend List, 1869', TGJ/1/3/2, BT Archives. 'Colin Brodie Papers, 1862-1871', 247.

[323] 'Articles of Agreement between ETC and UPTC' 3 September 1861, TGA 1/9, BT Archives.

given the option to connect their private wires to ETC in order to access the long distance, inter-urban network. ABC instruments were brought into ETC telegraph stations for this occasion, and these devices were rented at a reduced price and operated directly by ETC. Customers were charged a competitive rate for the transmission of messages through the ETC network.[324] The exclusivity was waved for connection to the Submarine Telegraph Company, in an obvious reference to the services offered by UPTC to Julius Reuter, but on the condition that the despatches were only directed to the newspapers, and did not compete with the newsroom service offered by ETC. From UPTC's perspective, it resulted in two types of rentals: the first type, and the most important, was between subscribers (for instance, between two offices), and the second type was between a subscriber and an ETC telegraph station.

The business model adopted by UPTC was different from other telegraph companies. As can be seen in the *Glasgow Herald* article below, UPTC sought to obtain first a sufficient number of subscribers in a given district before investing in the infrastructure, which consisted in the laying of the main cables, and then extending the wires to customers' premises via the junction boxes described in the 1860 patent specification.

> To render such a system applicable to Glasgow it is only necessary for some of the leading merchants informing the engineer that they agree to combine together and to rent wires of the company, either as communications between their mills and the nearest police and fire station, a most important protection against serious loss in the event of any outbreak, or as communications from their residences to their offices.[325]

[324] Telegrams for private wire customers received over the public wires were also forwarded to the customers over the private wires instead of being sent by messenger. Such customers were charged for the use of the office and the services of the clerks who attended the instruments.

[325] 'The Universal Private Telegraph Company and Our City Telegraphs'.

The wires were then rented on the basis of rates that reflected the distance between the two end-points, and the instruments were either rented or sold outright.[326] This innovative subscription-based business model ensured that capital expenditure yielded a faster return on investment compared to the more traditional, capital-intensive approach adopted by ETC and other telegraph companies.

Having first started its operation in London, UPTC then expanded to Manchester, Glasgow and Newcastle. Other markets were then served from these four locations. For example, London also looked after Birmingham, Derby, Bristol and Coventry, while Manchester extended it business to Liverpool. Unlike the companies that offered a telegram service, UPTC did not need a presence in all towns and cities because messages were transmitted and received directly by the customers. There was no need for public offices, for clerks to transcribe telegrams, for messenger boys to deliver telegrams; the result was minimum management overhead and a lean operation.

Because UPTC focused its activities in urban districts, the stronghold of public telegraph companies on railway or canal routes was therefore not an issue, and the implementation of the aerial infrastructure using house-tops and street poles progressed swiftly.[327] There appears to have been little opposition from landlords and

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[326] UPTC initially rented instruments at a rate of £6 per set per annum, while wires were rented at a rate of £4 per mile per annum in London. The General Post Office later criticised UPTC for not providing uniformity of rates. They were subsequently set at an annual rental of £8 per mile for house-tops or underground, or £6 if on the road, for London; and £7 and £5 respectively in other places. 'Rates and Conditions of Service by Private Wires' 12 July 1870, Post 30/202B, BT Archives. See also: 'UPTC Terms of Use', *The Times*, 8 April 1861, 5.

[327] To connect offices to factories outside towns and cities, UPTC made arrangements with railways where possible (this was the case with North London Railway, South Eastern Railway, Great Eastern Railway and London & North Western Railway). Besides the railways, UPTC also sought permission to erect telegraph poles along turnpike roads, canals and docks (for

occupiers for using their roofs to affix these poles.[328] In London, the first invoice for a private network was sent in April 1861 to Silver & Co, also UPTC's main cables supplier, for a line extending eight miles from Bishop Gate to Silvertown, and many more customers were soon to follow. The bulk of the infrastructure, the multi-tenant cables, was deployed within the first few years of operation. The ledger entry for 6 June 1861 also indicates a payment of £306 2s 1d. for 24 miles of wires between Finsbury Square and the Royal Exchange, and a further £1,760 16s. 8d. for 158 miles between the Royal Exchange and Waterloo Place.[329] According to Colin Brodie, by September 1862, 526 miles of wires had been installed in London, and in December 1867 the metropolis network totalled 926 miles of wires.[330] The topology for the London infrastructure was based on ten major electric highways, comprised of cables labelled A to K. Line A, for instance, was a 30 strand cable, serving the City in Birchin Lane, Moorgate, King Street, Finsbury Square and so on. Line C was a 50 strand cable serving Parliament Street, Bridge Street, the Clock Tower and the House of Commons. The fitting of the lines was done by Reid Brothers, and the overall cost of these lines varied initially from £11 to £16 per mile – a significant reduction compared to the £50 per mile achieved in the Waterlow & Sons

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instance, the Blackburn & Preston Turnpike, the Regents Canal or the London Docks Company). The rates varied, with some poles being rented for £1 per pole per year.

[328] 'Refused Access', *Manchester Times*, 3 August 1861, 7. On one of these rare occasions, the vestry of St Andrew Undershaft refused permission to UPTC to run a wire through the tower of that church.

[329] No information is given as to the type of cables installed, which could have from 10 to 60 individual wires. The price per mile in this instance was about £12 per mile.

[330] 'Colin Brodie Papers, 1862-1871', 393. This mileage included 46 miles for the police lines (Scotland Yard, City of London Police), but excluded the lines in Birmingham, Coventry and other towns managed by UPTC's London office.

project. By the end of the 1860s, the Manchester area network totalled 519 miles of wires, while the network of Newcastle reached 431 miles.

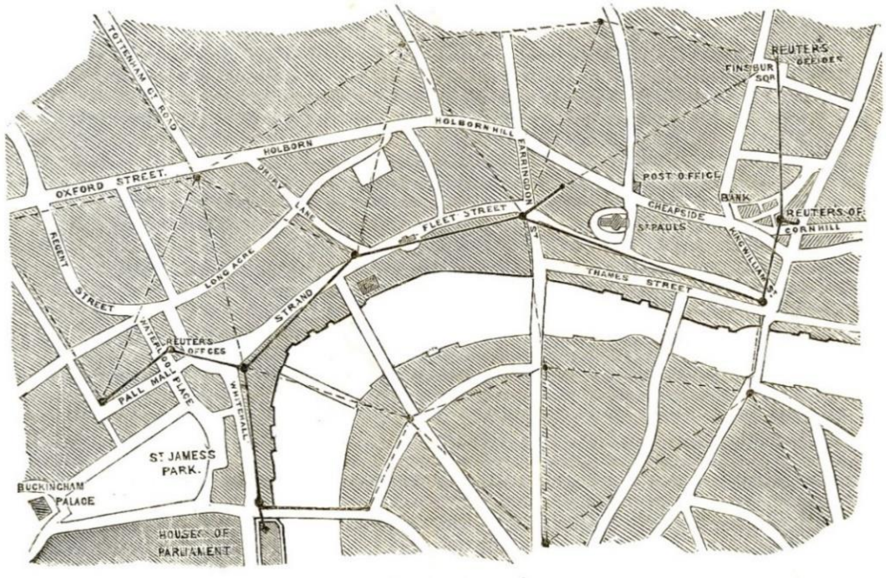

Figure 4.5. UPTC metropolitan network in 1861. The dashed lines are presumably the planned routes. The triangulation technique described in the 1860 specification can clearly be seen in this representation, but at this early stage of development the trunk line infrastructure was mostly linear.[331]

As reported by *The Times* on 8 January 1863, nearly 30 per cent of the 7,600 shares had already been subscribed to by this date. In March 1865, in its third annual report the company reported an income of £4,212 from which they offered a dividend of six per cent.[332] It is also worthwhile mentioning that in that same report the directors already noted that 'the prospects among the coal proprietors of Newcastle, South Wales and other mineral districts were encouraging', and it will be seen in the next chapters that collieries made significant use of private wires.[333] In its last full year statement to

[331] 'The Electric Telegraph Made Easy', *The London Review of Politics, Society, Literature, Art, and Science*, 16 March 1861, p. 288.

[332] 'UPTC Third Annual Report', *The Economist*, 18 March 1869, 315.

[333] 'Universal Private Telegraph', *The Times*, 23 March 1865, 9.

30 June 1868, UPTC showed an annual income of £8,344 and a dividend payment of seven per cent for twelve months.[334] As part of the nationalisation process, the company was eventually dissolved at a special general meeting which took place on 25 January 1870 following the passing of the Bill 'to provide for the winding up of the Universal Private Telegraph Company and for other purposes' on 12 January 1870.[335]

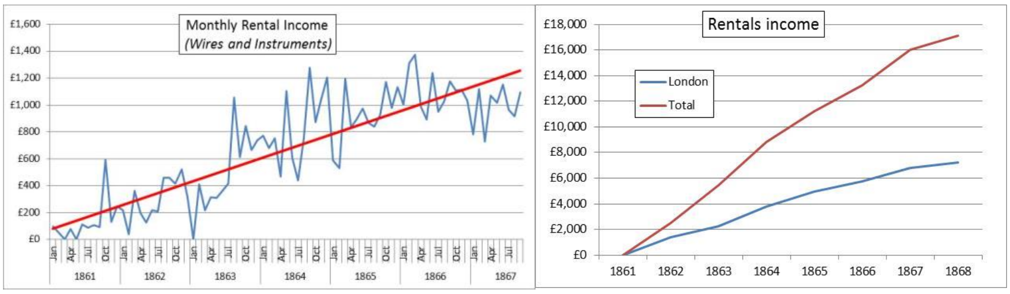

Figure 4.6. Evolution of UPTC rental income, compiled from cashbook entries.[336]

As can be seen from the above figure, the rentals of private wires increased steadily during the lifetime of UPTC – a reflection of the growing acceptance of private telegraphy as a business communication tool.[337] These figures do not include the sales of equipment, or the revenues from public telegraphy.

UPTC was also involved in public telegraphy, although this was an ancillary activity which generated little income from the transmission of telegrams and porterage. UPTC had seen a business opportunity in the gaps in network coverage left by the main public

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[334] This annual income was later restated during the negotiation with the Post Office (see Chapter 5). 'Universal Private Telegraph', *The Economist*, 3 April 1869, 388.

[335] 'UPTC Special General Meeting', *The Times*, 13 January 1870, 13.

[336] 'UPTC Cashbook', TGJ/2/2/1, BT Archives.

[337] There was no sudden acceleration in the diffusion of this innovation. This steady, almost linear growth, which may seem at odds with some diffusion theories, can be explained by the nature of the subscription-based model and the self-limiting infrastructure.

telegraph companies. In January 1862, Holmes went to Ireland with the aim of establishing direct communication between Cork and Queenstown, as well as between the south-east coast of Ireland and South Wales.[338] However, ETC had also the intention of providing such services and a court battle followed, with ETC complaining that UPTC was in breach of their 1861 agreement. The judge could not fault UPTC because ETC did not yet have a service in that area, but to protect its commercial interest and its profitable relationship with ETC, UPTC settled the matter out-of-court and withdrew from the race, thus letting ETC compete head-to-head with MTC for the service.[339]

Three years later, UPTC attempted again, this time more successfully, to establish a public telegraphy service. The Cantyre Line of telegraph, also called the West Coast Telegraph (or the West Highland Lines), was built by the Reid Brothers and opened on 4 September 1865.[340] At one point it was consolidated with the Glasgow District Telegraph, and it covered towns as far as Oban, offering a 'uniform shilling rate' between Glasgow and the other West Coast stations. Later in the century, one of the challenges faced by the General Post Office in this area was the delivery of letters to remote islands. The idea of a daily postal service across Skye was studied but abandoned in favour of a once-a-week call from Oban to islands such as Eriskay.[341] It is interesting to note that this island's Post Office was featured in a film documentary where an ABC instrument was seen in operation as late as 1935 over a telegraphic line from Eriskay to Oban and

[338] 'News from Ireland', *The Times*, 24 January 1862, 4.

[339] 'ETC v. UPTC', *The Times*, 8 March 1862, 11.

[340] 'Telegraph Extension', *Glasgow Herald*, 5 September 1865, 5.

[341] 'West of Scotland Mail Services', *Glasgow Herald*, 3 November 1897, 10.

from there to the rest of the country.[342] This is the only documented case of an ABC instrument having been used in public telegraphy.[343]

Figure 4.7. It was standard practice to affix stamps to messages in lieu of cash payment for sending telegrams, a practice which reinforced the idea that public telegraphy was an alternative to postal services. UPTC was no exception: this sixpence stamp was used to pay for telegrams on the Cantyre and other public lines of telegraph.

By December 1868 1,513 sets had been produced, of which 1,332 had been rented out, the rest having been sold.[344] The total mileage installed was 2,898 miles of wires, of which 2,336 had been rented out – a remarkable average utilisation of 80 per cent. The average monthly rental income for that year was £1,426, again a steady progression from the previous years. The ratio of mileage of wires rented to the number of rented instruments produces an average distance of 0.87 mile per rental, confirming the urban nature of the infrastructure. London was by far the biggest market, but the utilisation of the infrastructure in the capital was below 73 per cent – perhaps reflecting the size,

342 Maurice Harvey, *The Islanders* (Panamint Cinema (GPO Classic Collection), 1939).

343 Two other smaller public telegraph services were operated, accruing a very small amount of revenue. These were the Blythe Line of Telegraph and the Blythe & Chester-le-Street Line.

344 'Colin Brodie Papers, 1862-1871', 426–32.

complexity and spread of the network. By comparison, Glasgow and Newcastle had a utilisation rate of 89 per cent.

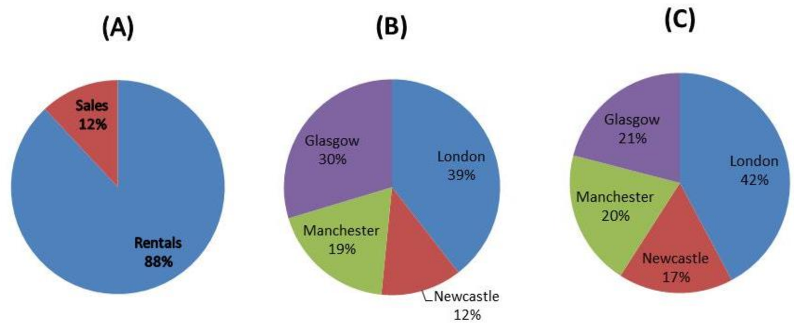

Figure 4.8. UPTC business snapshot at the end of 1868: rentals v. sales (A), rented instruments per market (B), and rental income per market (C).[345]

4.3. The wide appeal of private telegraphy

UPTC order books have apparently been lost, but I compiled a partial list of customers from accounting and engineering records, and from the occasional references in newspapers and journals.[346] The summary profile which emerged from this list, which can be seen in Appendix 1, shows an eclectic customer base, and such diversity demonstrates the wide appeal of private telegraphy.

Several market clusters can be identified from this list, with the industry, public, media and publishing sectors the largest of these clusters. There were also concentrations of customers in the financial, transport, utility, shipping and mining sectors. But the public sector was the most significant after industry, with police

[345] 'Colin Brodie Papers, 1862-1871'.

[346] Silver & Co also acted as distributor for UPTC products and services, but no record of their order book can be found either.

authorities well represented within this group.[347] The idea of connecting the City of London police stations via private wires was first proposed by Sydney Waterlow in 1857, but it was not until the end of 1860 that the Reid Brothers began implementing the star-shaped network that connected the Superintendent Office to the six stations in Fleet Street, Smithfield, Moor Lane, Bow Lane, Bishops Gate, and Seething Lane.[348] The *Manchester Times* reported on 4 August 1860 that the new A Division police station in Manchester had also been built with a telegraph office that was directly connected to the Town Hall via a private wire; also in the Manchester area, Oldham Police was listed as a UPTC customer, and so was the Leeds Police. In 1862, the Metropolitan Police connected the head office at Great Scotland Yard with each division's chief officer, a total of 48 miles of wires and 21 instruments, plus a few extra bells.[349] The City of London Police had been a pioneer for other forces to follow: they were the first police organisation in the country to perceive the benefits of private telegraphy as a real-time alert mechanism, greatly improving the reactivity of policing in the event of an emergency. Eventually, the technology was embedded into the work practices of the organisation and its perceived value was communicated back to the market, creating a strong incentive for others to follow – a process described by Lie and Sorensen as 'consumption as production'.[350] The effect of this secondary production was a positive

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[347] Many other institutions adopted private telegraphy. Cabinet Ministers were the first. Lord Palmerston's residence in Picadilly, for instance, had a private wire to Downing Street; others were linked to Whitehall or the Treasury. Other government agencies included the Board of Trade, the Commissioners of Inland Revenue, the Commissioners of Woods & Forests, Her Majesty Customs, the Office of Works, and the War Office.

[348] 'City Police Telegraph', *Daily News*, 9 November 1860, 7.

[349] 'Colin Brodie Papers, 1862-1871', 26.

[350] Lie and Sorensen, *Making Technology Our Own - Domesticating Technology into Everyday Life*, 8.

feedback loop which accelerated the take-up process. Moreover, the incorporation of the technology into operational practices made it difficult to withdraw it, as this would have resulted in a degradation of the service provided to the public. It is this aspect of private telegraphy that made it a transformative technology: once routinized by its users, the process was virtually irreversible.

A similar situation occurred in the media and publishing sector. In this case, the early adopter was Julius Reuter and the trigger point was the meeting held on 21 December 1860 in his office. The perceived value attached to the technology was also (near) real-time information, but it was of a different nature. In 1859, Reuter had acquired exclusive rights to supply foreign telegrams.[351] Telegraphic despatches from the Continent arrived via submarine cables to the Reuter's office and from there were transcribed and dispatched by messenger boys to newspapers. The 'last mile' operation was slow and cumbersome and Reuter immediately saw the value of private wires for his operation: the ability to reduce even further the latency of news transmission by providing an end-to-end despatch information service to newspapers. At least eight of the London newspapers were subsequently connected to Reuter's office via private wires. The newspapers also started at this point to install private wires for their own operation to increase the speed of political and financial news reporting. The Queen's printer Eyre & Spottiswoode installed ABC instruments in the House of Commons to send messages to its printing office near Fleet Street to speed-up the ordering process, as Waterlow & Sons had done a few years before.[352] Messrs De La Rue, then printers

[351] Briggs, *Victorian Things*, 378.

[352] Andrew Wynter, 'The Nervous System of the Metropolis - Part 1', *Once a Week - An Illustrated Miscellany of Literature, Art, Science, & Popular Information*, 2 March 1861.

and publishers of stamps, diaries, almanacs, pocket books, wedding stationery and playing cards, amongst other printed material, were also one of the first UPTC customers in London. And so were W.H. Smith & Son who, in 1860, had acquired printing works to complement their newspaper distribution business. All these firms had witnessed the effectiveness of the (Reuter's) telegram local delivery network, and it is likely they were influenced by it. Moreover, the competitive nature of the sector ensured that the advantage gained by one firm through the use of private telegraphy was short lived, as others appropriated the technology in response. In the news business, this was an irreversible process too, as once bankers, brokers, traders and businessmen became accustomed to receiving near real-time financial information it would have been awkward to revert to a slower operation.

As can be seen from these early examples, private telegraphy accelerated the pace of doing business. As early as 1857, Waterlow & Sons had integrated the technology into their daily routines to shorten the order-to-production process. Messengers were no longer needed to carry purchase orders from Parliament Street to Birchin Lane. Instead, all that was needed was the transmission of orders over the private wires. It was a matter of minutes instead of hours, and such a gain of time was critically important when orders had to be fulfilled within twenty four hours, as in the case of Waterlow & Sons and their dealings with Parliament. The immediacy afforded by telegraphic messages, devoid of recourse to collection, transcription and delivery services, accelerated indeed the pace of business.

Industrial firms were also quick to perceive the potential benefits of private telegraphy, starting with the Platt Brothers who employed private wires to speed up communications between their two sites. As pointed out by *The London Review*, a large number of manufacturers had the telegraph 'laid on between the counting-houses and the manufactories'.[353] There was also, as noted by the directors of UPTC in 1865, a growing interest on the part of collieries. Indeed, private wires could also be combined with various instruments to enable communication between machines, or between machines and humans.

The patent filed on 2 June 1858 included one such instrument: an 'electromagnetic telegraphic clock' (also called a 'sympathetic clock') which could synchronise its operation with a master clock via private wires. Time synchronisation, as will be seen in the next chapter, was an important application of private telegraphy, although it did not always involve clocks. On 18 August 1863, for instance, an experiment was conducted to provide Newcastle with Greenwich Time. At exactly one o'clock that afternoon, an electric signal was sent from the Royal Observatory in Edinburgh to Newcastle to fire a 32-pounder cannon.[354] The master clock in Edinburgh had been set previously to Greenwich Time by astronomical means, and was equipped by Mr Holmes (UPTC's engineer) with what the *Newcastle Courant* described as Wheatstone's magnetic explorer instrument. From Calton Hill in Edinburgh, ETC had installed a 120 mile long private wire along the railways all the way to Newcastle. The simultaneous firing of the guns in Edinburgh and Newcastle thus brought Greenwich Time to Newcastle and marked a new era in time synchronisation – much to the benefit of the public according to the local mercantile community.[355] As will be seen in the next chapter, time signals

[353] Anon, 'The Electric Telegraph Made Easy', 289.

[354] 'Newcastle Time Gun', *Newcastle Courant*, 21 August 1863, 5.

[355] 'Time Gun for Glasgow', *The Times*, 30 September 1863, 12.

were later delivered directly to Newcastle and North Shields from Greenwich via the ETC network.

The wide variety of private wire applications, together with the growing customer base, suggests that any prejudice or misconception about the electric telegraph which may have existed in the 1850s had been overcome by the late 1860s. By then, private telegraphy had become a prevalent business communication tool.

4.4. An international perspective on private telegraphy

Earlier in this chapter I stated that Waterlow and Sons were the first organisation in Britain, and possibly the world, to employ telegraphy as an unmediated business communication tool that combined private wires with on-premises telegraphic instruments – a model exploited commercially by LDTC and UPTC from the late 1850s onwards. Indeed, no other country appears to have adopted such a model of telegraphy at the time. But there were variations on the theme of private telegraphy. I examine below two countries, France and the US, where such variations occurred.

In France, telegraphy was controlled by the government from its inception and the concept of 'télégraphie privée' was introduced, almost as an afterthought, in 1851.[356] On the first of March of that year, private messages were allowed to be transmitted, for a fee, over the intercity telegraphic infrastructure which, until that date, had been reserved exclusively for official government communications. In effect, in France private telegraphy referred to what was described in Britain as public telegraphy: a public

[356] Gustave Marqfoy, 'Nouveau Système de Télégraphie - Rapport Présenté À Sa Majesté l'Empereur', 1859, BNF.

service not unlike the one offered by the Post Office for collecting, conveying and delivering despatches. The take-up of this service was modest compared to its British counterpart: 9,014 despatches were transmitted in 1851, growing to 475,050 by 1857.[357] Initially, specific (Louis) Breguet instruments that emulated the signals of the optical telegraph (semaphore) invented by Claude Chappe were used in order to capitalise on the existing pool of skilled operators. These instruments, however, were gradually replaced with more efficient Morse instruments – first, by manually operated instruments that transmitted from five to fifteen words per minute, and then by fully automated devices that transmitted pre-recorded despatches at speed up to forty words per minute.[358] By 1858, 186 stations had been opened to the public in the cities and the largest towns of the country. The following year, telegraphic taxes were lowered and the tariffs simplified in an effort to promote further the service: the cost of a message of twenty words was set at one franc for a despatch transmitted within the sender's county ('département') or to one adjacent to it, and two francs for those transmitted further, with the cost of each additional five words set at twenty-five and fifty centimes respectively. Three further simplifications were made to the service at this time: first, the regulations were changed to remove the need for the sender to come in

[357] By comparison, in Britain the number of messages transmitted were 99,216 and 881,271 for 1851 and 1857 respectively, and for the Electric & International Telegraph Company alone. Kieve, *The Electric Telegraph*, 68.

[358] This was a two-step process: in the first instance, the despatches were recorded on a 'cylinder' that was then inserted into an apparatus that read the cylinder and transmitted the messages at a constant speed to reduce the number of transmission errors. Such instruments were likely to be the ones designed by Messrs Paul Garnier and Marqfoy. Théodore Du Moncel, *Exposé Des Applications de L'électricité - Télégraphie Électrique* (Paris: Arts & Metiers, 1874), 184. In the 1860s, France had also adopted David Edward Hughes' type-printing telegraphs manufactured by Paul-Gustave Froment in Paris. Such instruments employed keyboards and synchronised type-wheels. Dionysius Lardner and Edward Brailsford Bright, *The Electric Telegraph* (J. Walton, 1867), 265.

person to a station to prove his identity; next, the prepayment by stamp was introduced; and finally, despatch boxes (‘boîtes à dépêches’) were installed at convenient locations within Paris to serve as collection points for telegrams, with collections organised 48 times per day, from 8 a.m. to 8 p.m. In France then, private telegraphy was about private communications over a shared public infrastructure. In analysing the source of such communications, it is interesting to note that the commerce, manufacture and financial sectors represented nearly seventy-four per cent of all the traffic, with private and family affairs communications from the general public counting for only twenty per cent.[359]

In the US, like in the UK, public telegraphy had been established by entrepreneurial private telegraph companies. At first, there was a large number of small regional telegraph companies, the majority of which used the Morse system. This highly fragmented market was not sustainable and it led to a consolidation process which resulted in a handful of companies emerging as dominant players. One such company was the New York and Mississippi Valley Printing Telegraph Company, renamed the Western Union Telegraph Company in 1856.[360] Western Union and its main competitor, the Atlantic and Pacific Telegraph Company, provided intercity telegram services. As in Britain, despatches were collected at local stations, transmitted by skilled operators on the extensive long distance telegraphic networks, and received, transcribed and

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[359] George Prescott, *History, Theory, and Practice of the Electric Telegraph* (Boston: Cambridge University Press, 1860), 216.

[360] The New York and Mississippi Valley Printing Telegraph Company was founded in 1851 by Hiram Sibley. In 1861, the company, by then called Western Union, established the first transcontinental telegraph line to California. Michael T. Allen and Hecht, eds., *Technologies of Power* (MIT Press, 2001), 28.

delivered to the recipients by messengers. But domestic private telegraphy in the US took a different turn to that in Britain. In the early 1870s, a company called the American District Telegraph Company (ADT) was formed to provide urban telegraphy in New York City, just as LDTC had done in London a decade earlier.[361] Also like LDTC, ADT introduced a private telegraphy service. But in contrast with LDTC's unsuccessful attempt at building a private telegraphy business, ADT's venture into private telegraphy was highly successful. ADT did not provide a telegraphic instrument to domestic customers for sending and receiving messages directly from their premises; instead, an electric 'call-box' was installed and connected by a private wire to a nearby ADT district office.[362] The private wire was actually semi-private, since up to one hundred or so customers could be connected to it in a configuration later known as a multidrop or party line. The customer simply actuated the device by pulling a lever to transmit a signal to ADT, who would then despatch a messenger within minutes to pick up the handwritten message to be sent as a telegram. The call-box was able to identify itself to the remote operator via a pre-programmed number. The simplicity and its affordability (a subscription to the service costing two and a half dollars per month) made this service very popular, especially as further services were eventually added to it, such as fire alert calls. Following a demonstration to Western Union in 1873, an agreement was struck between the two companies in 1874, with ADT providing access to the long distance Western Union telegram service (an arrangement similar to the deal between UPTC and ETC). The

[361] The American District Telegraph Company was the precursor of today's ADT Corporation, the security services company.

[362] According to Downey, the electric call-box was invented by Edward Calahan in 1871. Gregory Downey J., *Telegraph Messenger Boys - Labor, Technology, and Geography, 1850-1950* (Routledge, 2002), 40.

partnership between the two companies allowed each partner to concentrate on their respective core services: long distance telegraphy for Western Union, and urban telegraphy and local messenger services for ADT. This partnership forced the Atlantic and Pacific Telegraph Company to set-up a similar but not so successful service in New York City using an 'automatic signal telegraph'.[363] By the end of 1875, ADT had a workforce of 425 messengers in New York City alone (they were present in many other cities as well) and their success was such that they were unable to fulfil all of the 700 calls received at the 31st District Office (Broadway) on Christmas Day of that year.[364]

Many American firms also embraced the concept of private telegraphy. According to Du Boff, the first private telegraph line in the US may have been the one set-up in 1849 by the Magnetic Telegraph Company, between their New York telegraph office and a nearby printing equipment factory.[365] Private-line telegraphs, however, were not commercially offered in America until 1869, when the Gold and Stock Telegraph Company (GSTC) was strengthened by a merger with the Gold and Stock Reporting

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[363] Anon, 'A New District Telegraph System', *The Telegrapher*, 23 January 1875, 23.

[364] Anon, 'The American District Telegraph Company', *The Telegrapher*, 5 January 1875, 5.

[365] Richard B. Du Boff, 'The Telegraph in Nineteenth-Century America: Technology and Monopoly', *Comparative Studies in Society and History* 26, no. 4 (1984): 577. The Magnetic Telegraph Company was the first private telegraph company in the US. It was incorporated in 1845, and began operation that same year with a commercial line between New York City and Philadelphia. It also bought in 1847 the telegraphic line between Washington DC and Baltimore – the first commercial line in the US, which had been set-up in 1844 by Samuel Morse and the Post Office Department. David Hochfelder, *The Telegraph in America, 1832-1920* (Baltimore: The Johns Hopkins University Press, 2012), 32. In preparation for this first commercial line, Morse had experimented with one hundred and sixty miles of insulated wires in 1843, following a first experiment of thirty miles in 1842. Samuel Morse F. B., 'Experiments with Grove's Battery', *The American Journal of Science and Arts* 45 (October 1843): 390–94.

Company.[366] In addition to selling its ticker quotation subscriptions, the company began renting out private wires with type-printing telegraph instruments to financial institutions and other firms.[367] The instrument employed a keyboard together with a printer similar to the stock ticker devices, thus bypassing the need for a skilled operator. According to Hochfelder, private telegraphs were especially popular with banks, as clearing operations which previously had to wait for the return of messengers for the reconciliation to occur, could now proceed in minutes. In 1871, Western Union entered into the capital of GSTC and eventually controlled the company, although the two organisations remained separate firms, with Western Union concentrating on long distance intercity telegrams and GSTC dealing with urban private telegraphy.[368] The business of private telegraphy was highly successful and Western Union continued to 'regularly lease wires to private brokers, retail houses and banks' well into the 1880s.[369] But as in Britain, as we will see in Chapter 6, private telegraphy was soon overtaken by the development of the telephone.[370] Meanwhile, those business customers who had not selected private telegraphy for their communication needs, preferring instead the use of public telegraphy, had learned how to reduce the cost of telegrams while

366 Edward Calahan, the telegraph engineer who designed a ticker system and later the call-box, was involved in the formation of the Gold and Stock Telegraph Company. Hochfelder, *The Telegraph in America, 1832-1920*, 105–10.

367 In 1871, the Gold and Stock Telegraph Company charged thirty dollars per month for a two-mile line with two instruments. Ibid., 110.

368 Allen and Hecht, *Technologies of Power*, 29.

369 Downey, *Telegraph Messenger Boys - Labor, Technology, and Geography, 1850-1950*, 86.

370 When switching from private telegraphy to telephone, however, the written record of communications which the type-printing instrument had provided was not available anymore.

improving the confidentiality of transmissions through the use of telegraphic codes.[371] Employing telegrams for business communication though did not offer the level of immediacy and privacy afforded by GSTC's or UPTC's private telegraphy systems.

American private telegraphy thus followed two different development paths: for the domestic market, it was a pragmatic solution that employed semi-private wires and simple electric devices that gave customers a convenient way of calling messengers; for business customers, the solution provided by GSTC was similar to the one provided by UPTC in Britain a decade earlier – it consisted of dedicated private wires and user-friendly instruments that could be operated with very little training: a keyboard type-printing device for one, and a dial instrument for the other.

Waterlow and Sons were thus at the vanguard of private telegraphy when, in 1857, they demonstrated that a business communication tool that combined private wires and on-premises instruments was both feasible and desirable. A few years later, LDTC and UPTC began commercialising private telegraphy in the UK, and a decade or so later GSTC did the same in the US.

4.5. Conclusion

This chapter set about to demonstrate the distinctiveness of private telegraphy. I have shown that in contrast with public telegraphy which was generally perceived as a public institution of necessity and an alternative to traditional postal services, private

[371] For instance, the single word 'Alias' meant 'Your telegraph received too late for action today. Shall have attention tomorrow': in this case, one code-word replaced 12 words. A Chesebrough, *Private Telegraphic Code* (San Francisco: A. L. Bancroft & Company, 1878), 6. See also: Richard B. Du Boff, 'Business Demand and the Development of the Telegraph in the United States, 1844-1860', *The Business History Review* 54, no. 4 (1980): 459–79.

telegraphy came to be viewed as a business communication tool in its own right and without any precedent: a more direct, unmediated form of communication that created a sense of temporal and spatial immediacy as never before experienced with telegrams. Moreover, the economics of private telegraphy made it also fundamentally different to its public counterpart. The former employed dedicated end-to-end private wires that could only be envisioned for shorter (intra-urban) distances using a subscription-based business model, while the latter leveraged a shared infrastructure to make long distance (inter-urban) telegraphy economically viable.

Sydney Waterlow and Charles Wheatstone played a critical role in the early development of private telegraphy. This new form of telegraphy has been traced back to a bespoke private communication network built in 1857 by the firm Waterlow & Sons (a project implemented as a proof of concept for the City of London Police's communication network), and to a lesser extent to the launch of LDTC in 1859. Both undertakings vindicated Wheatstone's vision of a telegraph fit for domestic use; a vision articulated as early as 1837 and which became a reality some twenty years later.

Motivated by the Waterlow & Sons' project, Wheatstone resumed his work on his original dial instrument. By then, the 1840 patent and the terms of his settlement with Cooke had expired and he was free to develop further the technology without infringing upon Cooke's rights. The design of the ABC instrument was finalised in the patent of 1860. The life span of this user-friendly instrument, which was still in operation more than seventy years later, reveals its great success and its contribution to overcoming any prejudice or misconception about telegraphy. The patent of 1860 also described an aerial cabling system that made private telegraphy economically viable, and revealed Wheatstone's intention to set-up a private telegraphy business.

UPTC started its operation in 1860, first in London, and soon after in Manchester, Glasgow and Newcastle, to work Wheatstone's patents using a novel subscription-based business model: the laying of a multi-tenant telegraphic cable was undertaken only when a sufficient number of subscribers had been contracted for that area. The number of customers grew steadily over its decade of existence. By 1863, private telegraphy had become widely recognised as a necessity for 'every large public or private establishment having separate places of business.'[372] Government offices, police stations, fire brigades, newspapers, banks, merchants and manufacturers benefited from this means of instant communication with distant places. As the 1860s came to a close, UPTC had installed nearly 3,000 miles of wires and produced more than 1,500 instruments. Hundreds of organisations were by then routinely using private telegraphy.[373]

A similar want was expressed in the US, albeit slightly later than in Britain. The American solution for private telegraphy was also based on private wires and a user-friendly instrument, but in this case the instrument was a type-printing device which offered the additional advantage of recording the conversation. This would have been especially valued by banks and other financial institutions, which represented the main users of private telegraphy. Meanwhile in France, any private undertaking was prevented by the monopoly of the French government over telegraphic communications. Instead, private telegraphy was defined as communication between private users over a shared public infrastructure controlled by the State. Like public telegraphy in Britain at the time, the majority of its users were professionals. Private

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[372] Anon, 'Town Telegraphs', 462.

[373] By 1869, UPTC had rented private wires to about 700 organisations. See Appendix H in: 'Twenty Fourth Report of the Postmaster-General on the Post Office', 1878.

telegraphy may also have been available in other countries, but it is highly likely than Britain was amongst the first, if not the first country in the world to adopt telegraphy as a private, unmediated form of communication.

As I have shown in this chapter, private telegraphy was born out of a want for a more immediate form of communication. While LDTC chose continuity with the public telegraphy model, Sydney Waterlow departed from this established model and in so doing became an agent of technological change. In effect, he attributed a new meaning to an existing technology: he employed the needle instruments used in public telegraphy as private, intra-urban telegraphs over dedicated wires. The origin of private telegraphy is thus a prime example of interpretative flexibility. As this social shaping process demonstrates, Waterlow was not a passive recipient of the technology; he shaped it to suit his practical needs.

As we shall now see in the next chapter, the appropriation of UPTC by the Post Office as part of the nationalisation of the industry would further advance the cause of private telegraphy.

Chapter 5. The versatility of private telegraphy

When the Telegraph Act, 1868 received its Royal Assent on 31 July of that year, the Post Office had not yet recognised the potential of private telegraphy. In Chapter 3, evidence was presented that suggested that Frank Ives Scudamore, the architect of nationalisation, was initially only interested in public telegraphy during the years leading to nationalisation. In this chapter, I explain why and in what circumstances private telegraphy was eventually nationalised alongside public telegraphy, and to what extent the Post Office supported its development.[374] Moreover, in contrast to the previous chapter in which I examined the use of private wires for short distances involving direct communication between two ABC instruments, here I examine their use in long distance applications, with wires stretching between towns several hundreds of miles apart. In doing so, I reveal the influence of relevant social groups in shaping this technology, and demonstrate its versatility.

Extending the scope of private telegraphy to the 1880s, this chapter is comprised of the following sections:

In the first section (‘**the purchase of UPTC**’), which begins in 1868, I examine the appropriation of UPTC by the Post Office. As indicated in Chapter 3, Scudamore did not include the private wires in his original plan for nationalisation – a decision which lends

[374] Mr Patey, responsible for the telegraph business at the Post Office, commented when being examined by the 1876 Select Committee tasked with reporting on the Post Office telegraphs that the Post Office was ‘pushing the business [of private wires]’. ‘Report from the Committee on Post Office (Telegraph Department) Together with the Proceedings of the Committee, Minutes of Evidence, and Appendix’, 13 July 1876. 573.

weight to the argument that he (and others in the period) perceived public and private telegraphy as two very different forms of telegraphy. As it happened, it was UPTC who requested to be acquired by the Post Office along with the other telegraph companies. I explain UPTC's reasons for doing so, and then relate the events (namely, the disputes that led to two arbitration procedures) that occurred immediately after the Postmaster-General accepted UPTC's arguments to explain why the Post Office did not assume control of the private wires until July 1870.

In the second section ('**the private wires under the Post Office**') I examine the organisation of private telegraphy under the Post Office. The business of private telegraphy is then analysed by compiling statistics on revenues from rentals, the number of contracts, miles and instruments, to demonstrate that this activity was successful and increased significantly under the management of the Post Office. I posit that setting more consistent rates across the country was a factor in this growth, before turning my attention to the growing interaction between public and private telegraphy under the Post Office and arguing that the line between them was, in some cases, beginning to be blurred.

In the third section ('**special wires for the press and the stock exchanges**') I provide evidence that private wires were also employed in long distance inter-urban communication. Two cases in point are provided: the press wires for the newspapers, and the stock wires for the stock exchanges. In the first instance, I examine the provincial newspapers' special wires. Kieve and Barton (amongst other historians) described the electric telegraph as a critical technology for provincial newspapers, yet did not draw attention to the critical role played by private wires. Most provincial newspapers employed special wires, used by day for public telegraphy and rented at night for the transmission of large messages – in effect, becoming private wires. I begin by exploring the first use of the technology by Julius Reuter in 1859, before looking at the development of special wires for the provincial newspapers. I then introduce the Wheatstone Automatic telegraph, which involved the preparation of large messages, off-line, and their bulk transmission through the special wires. The Wheatstone Automatic was able to leverage the migration from iron to copper wires, which led to a significant gain in speed and reliability of transmission while reducing the cost of the network. Next, I explore the special wires employed by the provincial stock exchanges, which made it possible to communicate between exchanges in minutes rather than hours, and thus transform radically the operation of the securities market.

'**Regulating time with private wires**' in the fourth section is another case of long-distance private wires. Immediacy was paramount, as the delays which were inherent to public telegraphy could not be tolerated in the case of the transmission of time signals, as this would have rendered the service impractical. First, I set the context by introducing the time ball installed at the Royal Observatory in Greenwich in 1833, before exploring the one installed in London by ETC in 1859 for the dissemination of Greenwich Time to the network of 'sympathetic clocks' installed in all the major railway stations. Other cities followed suit using clocks and time guns that were also synchronised or triggered via timing signals transmitted over private and special wires, and I describe the systems installed at Liverpool in 1861, and Newcastle and Glasgow in 1863. Greenwich Time spread progressively across the UK to every town and village, and even throughout factories and offices, raising productivity and efficiencies. The private wires were the enabling technology behind nationally consistent timekeeping, and the comprehensive set of time signal services offered to the public reveals how the Post Office recognised the importance of this aspect of private telegraphy.

There were many other utilisations of private wires, and in the fifth section, '**from observatories to collieries'**, I demonstrate further the versatility of private wires by providing two more use cases. First, I describe a special wire extended between the observatories of Greenwich and Paris to aid in the precise measurement of longitudes. The second example deals with communications in the mining industry. Here, I reveal that collieries were employing private wires in pit operation as early as 1869, albeit with very different and simplified instruments. Collieries in Wales were also amongst the first customers to subscribe to exchange services, and I introduce the concepts of switchboards and dual use lines for telegraphy and telephony – concepts which will be further explored in the following chapter.

5.1. The purchase of UPTC

On 5 February 1870, the Post Office took operational control of public telegraphy.[375] It had taken six months to implement the Telegraph Act, 1869 – the instrument by which the Postmaster-General had been granted authority to acquire the telegraph companies. UPTC was not included in these appropriations which included ETC, MTC and UKTC. As it turned out, private telegraphy came under the control of the

[375] The transfer, originally scheduled for 29 January 1870, was postponed until 5 February 1870. See letters dated 13 December 1869 and 22 January 1870 in 'Lease of Special Wires to Newspapers' 13 December 1869, Post 30/287E, BT Archives.

Post Office six months later on 30 June 1870. I explain below the reason for this differentiated scheduling.

During the debate leading to the Telegraph Act, 1868, it will be recalled that the Postmaster-General (the Duke of Montrose) had stated that the Bill then before Parliament should not 'injure the interests of those who had a trade in private wires' and, therefore, that the government was not prepared to purchase UPTC. However, on 7 July 1868 the chairman of UPTC, Mr Jonathan Mellor, wrote to the Postmaster-General, contending that the business of private telegraphy would be destroyed by the introduction of a low and uniform rate for telegrams. This letter compelled the Duke of Montrose to look into the issue.[376] This statement from UPTC was rather exaggerated, perhaps even disingenuous, as it will be seen below that the private wires thrived under the Post Office despite the new tariff structure. At the time, however, Mellor may have perceived Scudamore's plan for considerably increasing the number of telegraph stations in the cities, and in London in particular, as a direct threat to the private wires business. This plan called for the opening of a central telegraph office in each district of the metropolis, the opening of subordinate telegraph offices in all sorting and receiving offices, the connection of these subordinate telegraph offices with the central telegraph office of that district, and the establishment of direct connections between all the central telegraph offices – in other words, an extensive network of interconnected stations that spread across the metropolis to make the telegraph ubiquitous.[377]

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[376] In files I and II: 'Purchase by the Post Office of the Universal Private Telegraph Company - Part 1'.

[377] UPTC had been prescient: by the end of 1870, the number of telegraph stations in London reached 334, of which 115 were in direct telegraphic communication with the Central Station

Montrose accepted Mellor's argument, and new articles were inserted in the Telegraph Act, 1869, to make it lawful for the Postmaster-General to purchase undertakings not mentioned in the Telegraph Act, 1868, and to allow companies to request the purchase of their undertakings.[378]

At that point, Mellor stated a net profit for the year to 30 June 1868 of £10,388 15s 5d – a sum which determined the purchase price of UPTC, that is, twenty times this amount. This statement prompted an audit request on the part of the Post Office, and on 19 August 1868, UPTC agreed for their books and accounts to be examined. Colin Brodie, the main engineer of the company (soon to be employed by the Post Office), was asked to visit the company's places of business in order to provide an updated status of the network. On the basis of this due diligence, the Postmaster-General decided to proceed with the acquisition, and two arbitrators were appointed to negotiate the settlement: Mellor for the company, and Scudamore for the Department. UPTC was also asked on 28 August 1868 to submit a proposal for working the private wires on behalf of the Post Office until the actual purchase of the company.

– four times as many as the number of stations LDTC had opened by the mid-1860s. Anon, 'Postal Telegraphy', 287. As seen in Figure 4.7 (c), the London rental business represented forty two per cent of UPTC's total income at the end of 1868, and any loss of market share in the metropolis would have been quite serious for the company.

[378] UPTC was not the only telegraph company offering private wires, although it was by far the largest. For instance, the Economic Telegraph Company, was another much smaller telegraph company offering private telegraphy in the Manchester and Liverpool areas using a Breguet dial instrument, similar to the ABC instrument. It had been (re)incorporated in 1866, and was eventually purchased by the Post Office which, in 1869, had estimated its value at £15,000. The company was wound up in 1872. See 'Closing of the Economic Telegraph Company', *Morning Post*, 3 June 1872, 7. and Hansard: 'Post Office - The Postal Telegraph Department - Resolution'.

On 15 October 1868, a new statement from UPTC claimed a net profit of £9,236 10s 11d for the year, to which they added the sum of £16,368 to be paid to Wheatstone for obtaining the rights to his patents (partly paid in shares), and an additional £6,674 10s 6d for reimbursing the expenditure in obtaining the company's Act.[379] Montrose categorically denied the last item, and sought legal advice as to whether the transaction between UPTC and Wheatstone amounted to a purchase within the meaning of the Telegraph Act, 1868, and whether the Postmaster-General, by acquiring these rights, would be forbidden to use any other instruments. Having been assured that the transaction between Wheatstone and UPTC amounted to a purchase and that it would not restrict the Department to the exclusive use of Wheatstone's instrument, Montrose asked the arbitrators to settle the monetary value of Wheatstone's rights as part of the overall purchase price of the company.

However, Mellor and Scudamore were unable to find a common ground. At the suggestion of the Department's solicitor, the case was thus laid before the Marquis of Salisbury, acting as an umpire.[380] This was followed by several months of proceedings in Committee Room D of the House of Lords in which several witnesses, including Brodie and Wheatstone, were heard.[381] The Royal Assent to the Telegraph Act, 1869, was finally given on 9 August 1869, in which the Postmaster-General was empowered to raise £184,421 for the purchase of UPTC, therefore assessing the net profit for the year ending

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[379] In file XVI: 'Purchase by the Post Office of the Universal Private Telegraph Company - Part 1'.

[380] The Marquis of Salisbury (Robert Gascoyne-Cecil) was 'a leading Conservative politician and gentleman FRS', described by Gooday as a technophile aristocrat. In 1880, he experimented with electric lighting. Gooday, *Domesticating Electricity: Expertise, Uncertainty, and Gender 1880-1914*, 2, 32, 160.

[381] In file X: 'Purchase by the Post Office of the Universal Private Telegraph Company - Part 1'.

30 June 1868 at £9,221 instead of £10,338. An extraordinary general meeting of UPTC was convened on 25 January 1870 in the company's office at 4 Adelaide Street in the Strand, to approve the submission of a Bill to Parliament to provide for the winding-up and dissolution of the company.[382] It was followed in 23 February 1870 by another meeting to empower the directors of the company to repay the shareholders out of the funds to be received from the Postmaster-General.[383]

The matter may have rested then, but a new dispute arose regarding the amount to be paid for the work done by UPTC on behalf of the Postmaster-General during the transition period, from 30 June 1868 to 30 June 1870. Here again, Mellor and Scudamore failed to reach an agreement, and an umpire (this time, Sir Joseph Napier, the Irish Tory MP and member of the Privy Council) was appointed to deal with the situation.[384] His award of £9,555 15s 10d to the company proved highly controversial. However, despite an attempt by the Postmaster-General (by then the Marquis of Hartington) to resist the decision, the matter was eventually settled and the company was finally paid for the work done during the interim period, although not until several years later.[385]

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[382] 'UPTC Dissolution', *The Times*, 13 January 1870, 13. In its edition of 28 January 1870, *Freeman's Journal and Daily Commercial Advertiser* reported a rounded-up purchase price of £184,000.

[383] Anon, 'UPTC Notice', *The Electric Telegraph and Railway Review* 1, no. 6 (19 February 1870).

[384] In file XIV: 'Purchase by the Post Office of the Universal Private Telegraph Company - Part 1'.

[385] In file XXXV: Ibid. The Post Office claimed that the department was owed £1,513 4s 9d by the company from the advance on rentals already paid out. The Department also found the award 'most unsatisfactory' as a very large fee was to be paid to the umpire. Failing to overturn the award, the Secretary directed the sum of £9,555 15 10s to be paid on 31 March 1876.

5.2. The private wires under the Post Office

On 1 July 1870, the Post Office finally assumed full control of the private wires and created a separate business unit within the Telegraph Department. Alan E. Chambre, then Second Secretary at the Post Office, was appointed as Surveyor of Private Wires, and Richard S. Culley, Chief Engineer, was at his side. Chambre managed a staff of three clerks for handling orders and other commercial matters.[386]

When questioned by the Marquis of Salisbury in April 1869, Colin Brodie had stated that as of 30 June 1868, 2,294 miles of wires had been rented out, and the income generated by the private wires business had amounted to more than £17,000. When the Post Office took over the operation of the private wires in July 1870, much effort was expended to promote them. Soon after, the mileage increased to 2,587 miles and the revenue to £22,500, and from then on, the business of private telegraphy kept growing, as can be seen from Figure 5.1. below. By 1890, the number of contracts had reached 3,543, the total mileage extended to 16,873 miles, and there were 9,251 instruments in operation. Private telegraphy was generating a revenue of £125,222 – a six-fold increase over two decades earlier. As Mr Patey, the officer responsible for the telegraph business, stated during his examination before the 1876 Committee, the private wires brought in profit to the Post Office.[387]

[386] 'Report from the Committee on Post Office (Telegraph Department) Together with the Proceedings of the Committee, Minutes of Evidence, and Appendix', 13 July 1876. 566.

[387] Ibid., 573.

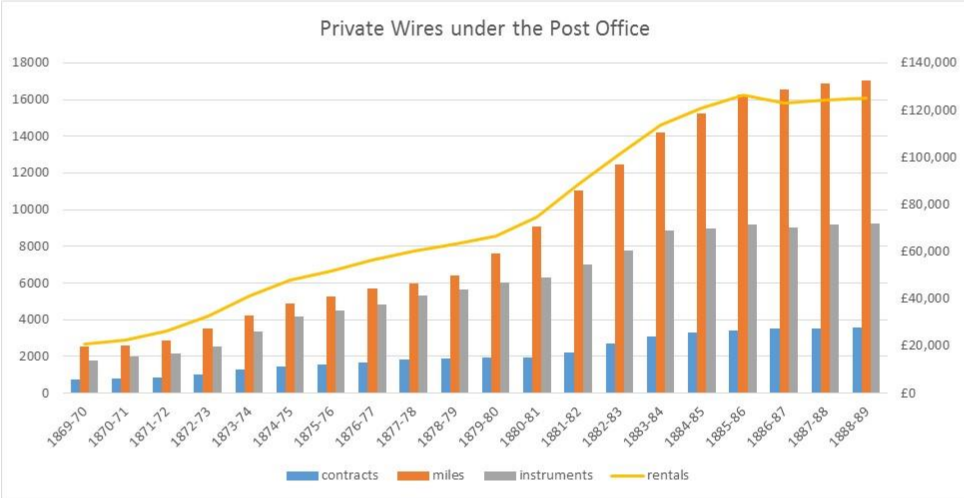

Figure 5.1. Private telegraphy increased significantly under the juridisction of the Post Office, but the impact of telephony can be seen from the mid-1880s. Source: Reports of the Postmaster-General on the Post Office (BT Archives, British Postal Museum & Archive).

One of the first actions that the Post Office took in 1870 following the audit of UPTC was to revise the tariff structure in order to make it more consistent across the country. For London, the cost per mile for a wire installed over house-tops or underground was set at £8 per annum, while a wire simply laid on the road was priced £6 per mile per annum; and for the rest of the UK, the rental prices were set at £7 and £5 respectively.[388] Wires laid under water attracted special rates 'according to circumstances'. The cost of renting an ABC instrument, including maintenance and repair, was now £6 per annum. As before, there was also the option of buying the instrument outright for £25, which included the transmitter, the receiver and the bell. However, to that price had to be added the cost of maintenance and repair, at £1 1s 0d

[388] It is interesting to note that a single needle instrument could also be purchased or rented (£7 10s 0d and £3 respectively) and the high cost of maintenance and repair for the needle instrument (£2 10s 0d) suggests an unstable device. Similarly, a telegraphic printer could also be purchased (£25) or hired (£10) with the cost of maintenance and repair, including paper and ribbons, set at £7 10s 0d per annum. It is the latter that was most likely used by newspapers. 'Rates and Conditions of Service by Private Wires' 29 September 1870, Post 30/202B, BT Archives. See also Chapter 4, footnote 326.

per annum. Private telegraphy was still an expensive commodity, yet despite these relatively high charges, the number of contracts grew steadily. The consistency of prices is likely to have been a factor in this growth as it would have simplified the commercialisation of these services.

Another action taken by the Post Office in 1872 and beyond in respect to private telegraphy – one which would have a significant and lasting impact on the development of telegraphy and telephony, as we shall see in the next chapter – was to begin creating systems of intercommunication between private wire renters using postal telegraph offices as central points, in a star-like configuration. The system was first established in Newcastle, Middlesbrough and Stoke-on-Trent, before being extended to Glasgow, Bradford, Swansea and other towns. By the end of 1874, there were 183 ABC instruments connected via private wires to telegraph offices – an increase of 75 lines over the previous year.[389] At first, the communication between two subscribers necessitated the manual retransmission of messages, as each private wire was terminated by a separate instrument in the telegraph office:

> When two or more lines of private telegraph are led into the same post office, it must be understood that telegrams received over one line intended for the renter of another line are to be sent to the latter by the instrument connected with his line and no charge is to be raised against either renter.[390]

Under such a configuration, it was also possible for private renters to send telegrams anywhere in the country by wire instead of by hand. The delivery of such

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[389] There were also 20 such instruments in London. 'Progress Report' 10 April 1874, POST 82/239, BT Archives.

[390] 'Instructions (Private Wires Form No. 11)' 10 April 1874, POST 82/239, BT Archives.

telegrams was charged at 3d within the local free delivery area, and normal delivery rates were charged beyond that.

By the late 1870s, the system was further automated to connect the renters to each other by means of an apparatus called an Umschalter – an intercommunication system also known for its generic name, switchboard.[391] In the Swansea district, for instance, several colliery proprietors entered into contracts with the Post Office in 1878 for the provision of intercommunication services.[392] The wires were arranged so that they terminated at the post office in Swansea. The intercommunication between renters was managed by an operator: on receiving a 'call' from a renter, the operator could either route it to another renter, thus putting the two renters in direct communication with each other, or to an ABC instrument located in the post office to receive the full message which was then either locally despatched by messenger, or retransmitted through the interurban network to a distant recipient. The next chapter explores further this critical technology.

5.3. Special wires for the press and the stock exchanges

The growth of private telegraphy, as seen in Figure 5.1., paralleled the growth of public telegraphy. By the late 1880s, the entire messages traffic reached 62 million – a tenfold increase over the traffic witnessed in 1870.[393] This explosion in the number of

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[391] 'Twenty Sixth Report of the Postmaster-General on the Post Office', 1880. 15.

[392] John E. Kingsbury, *The Telephone and Telephone Exchange, Their Invention and Development* (London: Longmans, Green, and Co., 1915), 84.

[393] 'Forty First Report of the Postmaster-General on the Post Office', 1895.

telegrams was largely triggered by the controversial decision taken in 1870 to reduce the rate to 1s for twenty words, irrespective of distance, with 3d charged for each additional five words. However, Members of Parliament who had opposed the nationalisation in 1868, felt vindicated by the poor financial results of the Department.[394] As pointed out by Kieve, the net profits from the telegraphs exceeded the interest charges on the debt created by the nationalisation only twice, in 1880-81 and 1882-83.[395] In other words, Scudamore had largely under-estimated the working expenses as well as the interest charges of the capital needed to acquire the companies and finance the extensions of the network.[396] The deficit was growing worse, and the reduction of the rates of telegrams in 1885 degraded further the financial situation.[397]

Nonetheless, it is interesting to note that usage of local (urban) telegrams also grew steadily, especially in London where the number of such messages reached nearly five million in 1889.[398] Scudamore's plan for the metropolis was working: the ubiquity of telegraph stations, together with the lower tariffs, fuelled the demand for telegrams over shorter distances, even though they still lacked the immediacy of messages sent

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[394] For instance, Mr Leeman, MP for York, 'a railway man' and the major opposition to the Bill, had warned the House against the overly optimistic estimates given by the government in 1868. 'Electric Telegraphs (Re-Committed) Bill - Committee'. Kieve, *The Electric Telegraph*, 147, 151.

[395] Kieve, *The Electric Telegraph*, 181.

[396] By 1877, the debt amounted to £10,250,000 (see footnote 272). The interest rate charged by the Treasury on this amount was three and a half per cent.

[397] In 1885, the rate was further reduced to 6d for twelve words, with a half-penny for each additional word.

[398] 'Thirty Fifth Report of the Postmaster-General on the Post Office', 1889. 11.

over private wires. The line between public and private telegraphy became increasingly blurred during this stage in the development of urban telegraphy.

Special wires also blurred this line, but at an earlier stage. Special wires were telegraphic lines that were rented out and dedicated to customers at night, but carried telegrams for the public during the day. In other words, special wires were private wires in all but name. I explore below two instances of special wires: the press wires and the stock wires.

It will be recalled from Chapter 3 that the electric telegraph had been used to feed stories to newspapers as early as 1845.[399] The transmission of news by telegraph spread quickly across the industry from this point onwards, and the idea of dedicating wires for this purpose soon followed. The minutes of ETC's board meeting of 29 April 1851, for instance, described a proposal from the Manchester District Committee to establish two direct communication lines between Liverpool and Manchester to report on the arrival of American steamers – presumably for the purpose of transmitting news from across the Atlantic without any delay.[400] By 1854, the intelligence department that ETC had created earlier to supply news clippings to subscribers of reading-rooms was now also supplying parliamentary and other types of news to 'upwards of 120 provincial newspapers', sometimes as often as twice a day.[401] The repeal of the newspaper stamp duty on 30 June 1855 led to a significant transformation of the British newspapers

399 'Portsmouth Lines'.

400 'ETC Board Meetings 1850-1853', POST 81/18 (TGA /1/3/2), BT Archives.

401 Wynter, 'The Electric Telegraph', 72.

landscape: dailies sprang up in provincial towns, fuelling even more demand for the latest news from London as well as from the continent and further afield.

Just before the repeal, *The Times* had been the dominant newspaper in the country with a circulation of about 50,000 copies per day, and it also possessed an extensive network of correspondents abroad.[402] The arrival of Julius Reuter in London in June 1851 was to challenge this supremacy and change radically the way international stories were fed to the country. Leveraging his contacts on the Continent and making use of the first Channel submarine cable which opened on 13 November 1851, Reuter began to organise his network of agents across Europe to feed stories and quotations from continental exchanges back to his offices in London – initially, two rented rooms in the Royal Exchange Buildings at a walking distance from his home in Finsbury Square. At first, Mowbray Morris, the Manager of *The Times*, stubbornly refused all offers to be supplied with continental news from Reuter. However, after the repeal of the newspaper stamp duty in 1855 *The Times* began to lose its dominant position to new titles, like the *Daily Telegraph* (141,700 copies by 1861).[403] As we saw in Chapter 4, Reuter was by then already supplying his telegrams to newspapers (apart from *The Times*), as well as to ETC and MTC who were paying £800 per annum to redistribute them to their reading-rooms across the country. For this purpose, Reuter had established private wires from his offices right into the editor's room of each journal where an ABC instrument terminated the line.

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[402] Donald Read, *The Power of News - The History of Reuters 1849-1989* (Oxford University Press, 1992), 19.

[403] Ibid., 20.

> The pedestrian, as he walks along Fleet Street and the Strand, will perceive high overhead what might be termed the political spinal cord of the metropolis; every here and there it gives off right and left fine filaments; these are going to the *Globe*, the *Sun*, the *Morning Post*, the *Herald*, the *Standard*, the *Telegraph*, and all the other daily papers which line this great thoroughfare. These are the lines by which Mr. Reuter puts the whole British public in possession of the thoughts, and records the actions of the rest of the world; and as we watch the wires ruling their sharp outlines against the sky, for all we know they are conveying words which may affect the destinies of millions yet unborn.[404]

The rivalry between *The Times* and Reuter for continental news, however, ended following an important event in Paris on 8 February 1859. This was the day the Emperor Napoleon III opened the Congress of the French Parliament with a much-awaited speech, as the situation in Italy was deteriorating and war with Austria, as a result, was a strong possibility. Reuter had managed to obtain a copy of the speech beforehand and had further negotiated with the Submarine Telegraph Company exclusive use the Channel cable for one hour at the exact time of the speech. As the Emperor started his speech, a Reuter's agent in Paris opened the sealed envelope which contained the speech to initiate its transmission by electric telegraph via this special wire.[405] Less than two hours later, the entire translated speech was printed in special editions and sold on the streets of London. This demonstration of speed and effectiveness in news delivery persuaded Morris to subscribe also to Reuter's news service. Indeed, conventional telegrams would have been unable to transmit this volume of information in such a short amount of time, and if it had, it would have been at the expense of the public telegraphy

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[404] Andrew Wynter, 'Who Is Mr Reuter?', *Once a Week - An Illustrated Miscellany of Literature, Art, Science, & Popular Information* 4 (23 February 1861): 246.

[405] Napoleon III's hopes for peace towards the end of the speech ('La paix, je l'espère, ne sera pas troublée' translated by Reuter as 'Peace, I hope, will not be disturbed') was short-lived as he declared war on Austria on 3 May 1859. It should be noted that the date cited for the Emperor's speech in Donald Read's book on page 25 (7 February) is erroneous. *La Politique Impériale Exposée Dans Les Discours et Proclamations de l'Empereur Napoleon III* (Paris: Henri Plon Editeur, 1868), 292.

traffic. By the late 1860s, Reuter was charging the London dailies a flat fee of £1,600 per annum for his services, as part of a contract that was reputedly impartial and non-exclusive. For the provincial newspapers which, by then, had managed to form the Press Association to break free of their reliance on the intelligence departments of the telegraph companies, Reuter charged £3,000 per annum for the supply of news to the Association.[406] With this episode, Reuter had demonstrated the usefulness of special wires which, together with the private wires that linked his offices with the newspapers, were ensuring the swift delivery of news.

The Press Association was first formed in 1865 in an attempt to resist the telegraph companies.[407] In Asa Briggs' words, 'As *The Economist* wrote, the Press when united is stronger than any other interest, and has suffered for years under the shortcomings of the private [telegraph] companies'.[408] The year before, ETC and MTC had indeed combined their intelligence departments as part of a joint arrangement designed to pool their resources to improve the quality of the service provided to the provincial newspapers which had hitherto complained of errors, delays and frequently unintelligible Parliamentary reports. As a result of this arrangement, the price of supplying news had increased to £200 per year – a price considered too high by the newspapers which still considered such news depreciated in value because the same news was also transmitted to the reading-rooms controlled by the telegraph

[406] Read, *The Power of News - The History of Reuters 1849-1989*, 45.

[407] George Scott, *Reporter Anonymous - The Story of the Press Association* (London: Hutchinson & Co Ltd, 1968).

[408] Briggs, *Victorian Things*, 379.

companies.[409] It is noteworthy that during their meeting of 17 October 1865 to form the Press Association, the newspaper proprietors had invited Nathaniel J. Holmes, the UPTC engineer, to talk about the practicality of creating their own (private) telegraph network.[410] No such network was ever built, but the following year the *Scotsman* and the *Glasgow Herald* made separate arrangements with ETC to rent special wires between London and Glasgow. Meanwhile, as we saw earlier, the pressure on the government to intervene was growing, and the daily newspapers joined the chambers of commerce in the lobby for the nationalisation of the telegraphs. As the Bill was being debated in Parliament, the newspaper proprietors held two meetings – the first in Manchester on 6 April 1868, the second on 29 June 1868 in London. Chaired by John E. Taylor of the *Manchester Guardian*, the latter convened twenty-eight dailies from Scotland, Ireland and the North of England, and an agreement was reached to form a new co-operative association to collect and supply telegraphic news.[411] On 6 November 1868, the Press Association Limited was registered, and John E. Taylor became its first chairman.

This effective lobby from the provincial newspaper proprietors resulted in an arrangement with the Post Office, reflected in the Telegraph Act, 1868:

> … the Postmaster General may from Time to Time, with the like Consent, let to any such Proprietor, Publisher, or Occupier the special Use of a Wire (during such Period of Twelve Hours per Diem as may be agreed on) for the Purposes of such Newspaper, News Room, Club, or Exchange Room, at

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[409] Previously, ETC typically charged weekly newspapers £35 per annum for this service. Barton, 'Construction of the Network Society', 195.

[410] Scott, *Reporter Anonymous - The Story of the Press Association*, 26.

[411] Ibid., 284. Amongst the provincial newspapers represented at that meeting were the *Birmingham Daily Post*, *Cork Examiner*, *Freeman's Journal*, *Dublin Daily Express*, *Edinburgh Evening Courant*, *Glasgow Daily Herald*, *Leeds Express*, *Liverpool Courier*, *Newcastle Chronicle* and the *Sheffield Independent*.

> a rate not exceeding Five hundred Pounds per Annum; Provided also, that no such Proprietor, Publisher, or Occupier shall have any undue Priority or Preference in respect of such Rates over any other such Proprietor, Publisher, or Occupier.[412]

The above excerpt from Article 16 of this Act, which refers to the 'letting' of special wires, reveals the successful outcome of this lobby. The arrangement between the Post Office and the newspapers in respect of the special wires was, with the exception of the capped fee, similar to the one that had been offered by the telegraph companies, which continued to supply intelligence to the Press until the date of the take-over on 5 February 1870.[413] It specified an operation between the hours of 7pm and 3am, London time. During this time window, a proprietor had the exclusive use of one wire over which any news could be sent – the Postmaster-General having no control over those messages. The clerks (operators), at each end of the wire, and at any other relay station in between, were being provided as part of the arrangement.

Figure 5.2. Newspapers were proud of showing that the news was transmitted via special wires.

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[412] For the proprietors or publishers who could not afford special wires, the Act also specified special rates: 1s for 100 words between 6pm and 9am, and 1s for 75 words between 9am and 6pm; with 2d per additional transmission of the same message - that is, for each new recipient (this low incremental cost for additional addresses was possible because of the use of the Wheatstone Automatic instrument – see below). 31 & 32 Vic. cap.110 - 31 July 1868

[413] Just prior to the transfer, the price charged by ETC for a special wire, including delivery of the messages to the offices of the newspapers, was £750 per annum. See 'Lease of Special Wires to Newspapers'.

Before the transfer to the Post Office, seven newspapers had rented special wires. Most of them were from Scotland, including the *Scotsman* and the *Glasgow Herald* mentioned above, but also the *Manchester Guardian* and the *Irish Times*. These newspapers continued to rent their special wires from the Post Office after the transfer. News was now also collected by the Press Association, which was likely, at this point in time, supplying news to reading-rooms and exchanges.[414] By 1875, the Post Office had signed up a total of nineteen contracts for special wires, making for a total revenue of £9,500 per annum (£500 each).[415] Its own intelligence department, which counted ten full-time clerks at the time, as well as extra staff as and when required, dealt mostly with the preparation of news for transmission to the country. It is noteworthy that three newspapers (*Scotsman*, the *Glasgow Herald* and the *Glasgow News*) had contracted for an additional wire, perhaps because of the volume of news involved, or perhaps to offer resilience in case of a failure of the first wire.[416] It is also interesting to note that the special wires rented by the *Scotsman* followed the west-coast route rather the more direct eastern route: it went from London to Edinburgh via Manchester and Glasgow. Apart from the necessary electrical relays, there was no break in the chain of communication, no interruption to the electrical signals. And on parliamentary nights it was not uncommon that an important speech delivered in London was being put in type

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[414] The Post Office forwarded news collected by the Press Association to 680 towns and 1,438 subscribers. Anon, 'Post Office Telegraphs', *Ladies' Treasury - An Illustrated Magazine of Entertaining Literature*, 1 February 1871, 30.

[415] 'Special Wires' 24 December 1875, Post 30/287E, BT Archives.

[416] When the wire was in good working order and not affected by environmental conditions, up to five or six columns could be transmitted (between 10,000 and 12,000 words), but bad weather could reduce the transmission to a single column.

before it was even finished, in the same way Reuter had done in 1859. With urban private wires in mind, the main newspaper proprietors even planned for more expansions:

> They propose to establish offices in London, and now that the telegraphs are in the hands of the government, the wire will be led into the metropolitan office and also to the printing offices in Scotland […] The correspondent in Fleet Street will then be able to do his Scottish work with as much comfort and despatch as he would in the High Street of Edinburgh, writing within hearing of the click of the type.[417]

Indeed, writing about special wires at about the same time, an article in the *Chambers's Journal* put it another way: 'the Scotch daily press may now be said to be sub-edited in London'.[418]

News also transited during the day as conventional telegrams, the so-called press telegrams. These press telegrams were used by the Press Association to despatch news to their subscribers in all parts of the country, and also to the 85 or so newspapers which could afford or were willing to pay the deposit of £25 for each and every correspondent the Press Association maintained in various towns.[419] Like the content transmitted over a press wire, the content of a press telegram was not censored. This was a clear improvement over the days of the monopoly of the telegraph companies which possessed the power of vetoing, withholding or giving priority to any class of news, however insignificant or important it might be for the public. Still, most newspapers endeavoured to establish special wires; not only those with long distance domestic

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[417] Charles Dickens, 'A Special Wire', *All The Year Round* 20, no. 490 (12 September 1868): 332.

[418] Anon, 'Our Special Wire', *Chambers's Journal of Popular Literature, Science and Arts*, 11 July 1868, 434.

[419] Charles Jr Dickens, 'Press Telegrams', *All The Year Round* 9 (New Series), no. 222 (1 March 1873): 365.

operations, but also those involved with international news, especially between the UK and the Continent. As the proprietors of the *Daily Telegraph* put it in 1875: 'it is of small use to give news briefly by telegraph one day and the same news at greater length by post the next day'.[420] They believe that the public would not read the same news twice, and that the only way was to give the complete news at first.

Both the press telegrams and the press wires were heavily subsidised. The price of a press telegram was 1s for 75 words during the day and 1s for 100 words at night, or roughly one third of the cost of a normal telegram.[421] This was not a trivial matter because, in the year 1875 alone, the press transmitted 220 million words via press telegrams (compared to 600 million words for ordinary messages) and generated a loss of £20,000.[422] The press wires were not exempt from subsidy either, even though private telegraphy was a profitable business overall (the special wires were reported as private telegraphy). As stated earlier, press wires were rented at £500 per year, but the members of the committee who looked at the lack of profitability of the Telegraph Department in 1876 pointed out that this calculation omitted to include a proportion of the cost of wayleave and maintenance (paid by the Post Office) for the time the wires were rented to newspapers.

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[420] 'Special Wire for the Daily Telegraph', *Liverpool Mercury*, 9 November 1875.

[421] The press telegrams were, for all intents and purposes, limited in length: for those longer than 200 words, 24 hours' notice had to be given to the Post Office. This, in effect, prevented smaller newspapers (without access to press wires) from receiving transcript of speeches for instance.

[422] 'Report from the Committee on Post Office (Telegraph Department) Together with the Proceedings of the Committee, Minutes of Evidence, and Appendix', 13 July 1876. 5056.

Figure 5.3. Picture of a Wheatstone Automatic Instrument. It consisted of three distinct devices: the perforator with the dispenser of paper behind it (left), the transmitter (centre) and the receiver (right). Photograph taken at the Porthcurno Telegraph Museum in Cornwall and reproduced here with their kind permission.

Most news bulletins transmitted over press wires or press telegrams were sent using the Wheatstone Automatic (see Figure 5.3.).[423] This telegraph instrument was not economical on short lines because of the number of staff required to operate it, and so was reserved for lines longer than 200 miles. This instrument had been designed for efficient bulk transmissions: the message was first recorded (off-line) on a punched strip of paper – the holes representing the letters of the alphabet in Morse code. This work was usually performed by female clerks who could record the message at the rate of about 40 words per minute. The strip of paper was then placed on a machine (transmitter) with a rolling cylinder and a tooth spring connected to a battery. To put it simply, as the tooth dropped into a punched hole, a current was established and transmitted to the distant instrument. The receiver had also a rolling cylinder with a strip of paper, this time washed with a solution of (yellow) prussiate of potash that changed the colour of the paper to blue when a metallic point pressed against it as the instrument

[423] Despatches from the Press Association during the day, for instance, could be sent to several stations in succession (towns on the same telegraphic line).

received an electrical impulse from the transmitter. Initially, the Wheatstone Automatic could transmit a message at a rate of between 80 and 120 words per minute, thus much faster than any other instrument employed by the Post Office at the time.[424] Culley, the chief engineer of private wires, remarked that the Wheatstone Automatic could transmit 400,000 words in one night to five or six stations simultaneously – in other words, two millions words transcribed in just one night.[425]

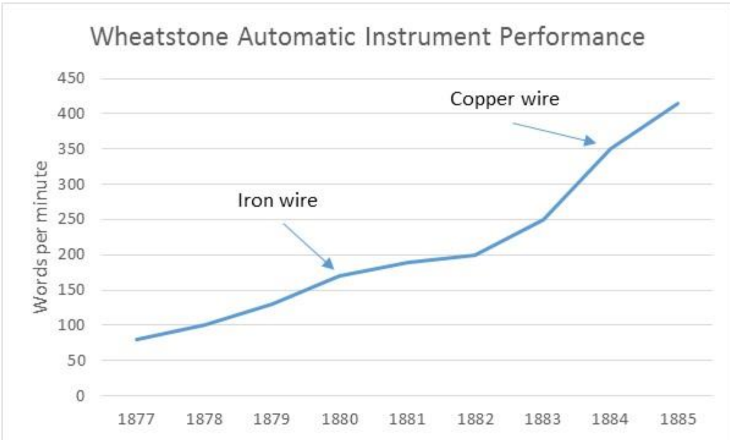

Figure 5.4. The use of copper wires on aerial lines significantly improved the speed of telegraphic transmission.[426]

The performance of the instrument was also dependent on the wires on which it operated. Initially, most wires were made of iron and required costly relay stations to ensure optimum transmission speed over such long distances. In the early 1880s, the

[424] In 1870, there were 160 instruments in Telegraph Street where the Telegraphs Department had its temporary headquarters following the transfer; most of these instruments were Morse or two-handle needle instruments. Andrew Wynter, 'Postal Telegraphs', *The Edinburgh Review* 132, no. 269 (1870).

[425] R.S. Culley, 'Automatic Telegraphs', in *Second Ordinary General Meeting of the Society for Telegraph Engineers*, 1872, 47.

[426] William H. Preece, 'On the Relative Merits of Iron and Copper Wire for Telegraph Lines', in *Report of the Fifty-Fifth Meeting of the British Association for the Advancement of Science Held at Aberdeen in September 1885* (London: John Murray, 1886), 909.

speed of transmission for the Wheatstone Automatic increased from 80 to more than 300 words per minute.[427] The advent of copper wires in the mid-1880s created a step change in transmission technology with their greater conductivity. Copper had previously been employed for short distance telephony, but its superiority over iron for long distance aerial wire was demonstrated in 1885, when William Preece ran a series of experiments between London and Newcastle to show its greater durability and 'susceptibility to rapid changes of electric currents'.[428] In 1887, the Postmaster-General reported the successful test of a copper wire infrastructure which had increased the rate of transmission to 450 words per minute using the Wheatstone Automatic.[429]

The press, however, was not the only beneficiary of long distance private wires. The financial sector, the stock exchanges specifically, also took advantage of similar special wires. As Ranald Michie pointed out: 'Contemporaries were immediately aware of the implications of this [ability to communicate between geographically distant centres] for the securities market but it was to take a number of years before they could

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[427] However, the high-speed Wheatstone Automatic was sensitive to weather, especially when using duplex or quadruplex circuits, and could even become useless unlike simpler instruments such as the ordinary Morse apparatus. 'Twenty Sixth Report of the Postmaster-General on the Post Office', 1880. 13.

[428] The maximum speeds reached during the tests were 414 (simplex) or 270 (duplex) words per minute with copper, compared to 345 and 237 respectively using iron. Preece, 'On the Relative Merits of Iron and Copper Wire for Telegraph Lines', 909.

[429] 'Thirty Third Report of the Postmaster-General on the Post Office', 1887. 9. It is interesting to note that the following year, the Postmaster-General noted that extensive use of copper wire was compromised by the 'abnormal rise in the price of copper'. After a fall in price, the shares of the leading copper mines more than doubled in value as the price of a ton of copper went from £45 in October 1887 to £85 in December 1887. 'Thirty Fourth Report of the Postmaster-General on the Post Office', 1888. 9. 'The French Speculation in Copper', *The Economist*, 31 December 1887, 1652.

make full use of the new technology'.[430] Indeed, long before nationalisation, the telegraph companies had recognised the importance of this sector by locating the telegraph stations near the stock exchanges.[431] However, this proximity was still not enough in some cases as we shall see below.

The first recorded telegraphic transmission of the mid-day and closing prices between the London Stock Exchange and the Manchester Exchange took place in 1848.[432] Attempting to speed up the delivery of such information, the stockbroker Pulley & Stutfield requested a private wire between the stock exchanges of London and Manchester and Liverpool, but ETC denied the request on 26 October 1852.[433] It is likely that the denial was motivated by self-interest, as both ETC and MTC eventually included this type of information as part of the service provided by their intelligence department, even though the provincial exchanges often found the service unsatisfactory. Yet despite their complaints over the late arrival of the messages, this type of traffic grew. Undeniably, brokers and dealers (also known as jobbers) made a profit in the fluctuation between the markets, and the telegraph was quickly adopted as an information and transaction tool.

> A man who is receiving a telegram every few minutes in the day has a knowledge of what every market has done in Leeds, Manchester, Glasgow and London. These are active telegraphic markets,

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[430] Ranald C. Michie, *The London and New York Stock Exchanges 1850-1914* (London: Allen & Unwin, 1987), 9.

[431] The floor of the London Stock Exchange was linked to the central telegraph station by a pneumatic tube to accelerate further the transmission and delivery of messages.

[432] The telegraph company providing this service was ETC. William Arthur Thomas, *The Provincial Stock Exchanges* (London: Frank Cass & Company Ltd, 1973), 102.

[433] 'ETC Board Meetings 1850-1853', 115. Anon, *Post Office Directory of London*, 940.

> and they frequently do very well indeed by not speculating for the account but by closing their books at night and buying and selling throughout the day by telegraph.[434]

The response (above) of Mr Withers, chairman of the Liverpool Stock Exchange, to a question by Mr Yorke, MP, during his examination before the Royal Commission on 20 March 1878, shows that usage of the telegraph grew unabated after nationalisation. One fourth of the telegraphic receipts in the town (of Liverpool), said Withers, came from the Liverpool Stock Exchange. The traffic between Manchester, Glasgow and London was even greater and at times exceeded the capacity of the wires. Special wires, so-called stock wires, were put in place between these cities and special clerks were allocated to this service.[435] However, the Post Office was reluctant to set-up stock wires between exchanges when the volume of message did not justify it because they employed considerable infrastructure resources. It took substantial lobbying efforts on the part of Glasgow to obtain the stock wire: Mr Anderson, MP for Glasgow, had to present a memorandum to the Chancellor of the Exchequer at the Treasury, signed by 100 of the most influential and respectable merchants of the city in favour of a direct communication between the exchanges of London and Glasgow to obtain the special wire.[436] As a result of this stock wire, it was possible to send a message, do the deal and

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[434] 'London Stock Exchange Commission - Report of the Commissioners Presented to Both Houses of Parliament by Command of Her Majesty', 1878, 7954.

[435] It must be noted that although most stock wires seem to have been installed after the nationalisation, the first stock wire may have been set-up as early as 1859 between the London Stock Exchange and the Bourse in Paris. The special wire was provided by the Submarine Telegraph Company using the cable which went from Folkestone to Boulogne. *Daily News*, 23 August 1859

[436] *Glasgow Herald*, 23 July 1872.

receive confirmation in less than half an hour.[437] Leeds had also managed to get its own direct stock wire to London in 1871, and an estimated 67,000 messages were sent on it in 1886.[438] Still, not all the requests were successful. For instance, the Aberdeen Stock Exchange complained that it took two and a half hours to communicate with the Liverpool Stock Exchange.[439] Indeed, the high latency of telegrams over a public network was an undeniable disadvantage when others were able to place orders in a matter of minutes. They, too, requested a stock wire to communicate with Liverpool and Manchester, but to no avail. In the end, they had no option but to send and receive their messages over ordinary wires. The reason for this refusal, according to Thomas, was that a direct communication between two provincial exchanges was only allowed if stock wires had already been established between these exchanges and London; that is, only if the volume of messages was significant. Otherwise, provincial exchanges were not permitted to employ stock wires between each other. Nevertheless, Michie wrote that between 1870 and 1899 the number of special wires between London and the provincial exchanges rose from 11 to nearly 60.[440] Stock wires, like press wires, were thus organised using a hub and spoke model centred on the metropolis.

[437] Michie, *The London and New York Stock Exchanges 1850-1914*, 9. Quoting the LSE Committee for General Purposes, 21 March 1876.

[438] W.A. Thomas quoting the Leeds Stock Exchange Minutes of 2 January 1895. Thomas, *The Provincial Stock Exchanges*, 103.

[439] 'Report from the Committee on Post Office (Telegraph Department) Together with the Proceedings of the Committee, Minutes of Evidence, and Appendix', 13 July 1876. 5136.

[440] Michie, *The London and New York Stock Exchanges 1850-1914*, 9, 10. (Quoting *Stocks Exchange Investments: Their History, Practice and Results* (5th ed., 1897), p.172).

5.4. Regulating time with private wires

The dissemination of accurate time across the country followed mostly the hub and spoke model, but there were some notable exceptions as I explain below. Like the press and the stock wires, the concept of time distribution using private wires existed before nationalisation.

The Royal Observatory at Greenwich introduced the display of time for the benefit of the public in 1833 using a time ball. The large and highly visible red ball was installed on a mast in one of the turrets of the Observatory. It was raised manually by a winch at fifty five minutes before the hour, before being dropped at exactly one o'clock. Holiday-makers visited Greenwich Park to watch the descent of the ball, but this daily event had first and foremost a practical use, both for the mariners on the Thames and for London's clockmakers which could be seen 'journeying to the Royal Park to take time from the fall of the ball'.[441] These were the days when towns and villages across the country used local times calculated by sundials and various other means, the accuracy of which, even within a town, varied widely. The exposure of 'true time' at Greenwich was thus an extraordinary event.

It was not until 1847 that the idea of transmitting the time by telegraph began to take shape. ETC's idea was to leverage its network infrastructure to synchronise the time in all the railway stations that had a telegraph office. A plan was concocted by ETC's engineer Edwin Clark and approved by the Astronomer Royal George Biddell Airy; it involved an electrical device that established a contact as the ball fell on a spring that

[441] Anon, 'Telegraph Time', *Fraser's Magazine* 2, no. 7 (July 1870): 19.

was connected to an ETC wire.[442] The project was actually started nearly five years later, in June 1852. It required the laying of a private wire between the Royal Observatory and ETC's offices on the Strand, where another time ball was erected. This ball was also red, but with a white band painted around it. It was sixteen feet in diameter and stood thirty feet above the cupola of the building.[443] As the time ball in Greenwich was released at exactly one o'clock, an electric current triggered the simultaneous release of the one on the Strand, and the public in the street below could watch the display. Later, the electric bells in every ETC telegraph station equipped for receiving the time service could be heard ringing in unison at precisely one o'clock.

Other towns soon began to provide Greenwich Time information to their citizens by telegraphic means. In 1861, for instance, the astronomical clock at the Liverpool Observatory was connected via an MTC's telegraphic wire to the Town Hall's clock. Both clocks were fitted with Alexander Bain's pendulum mechanism, which was complemented by an apparatus designed to regulate the motion of the pendulum, resulting in an accuracy of one or two tenths of a second between the two clocks.[444] The Observatory was also connected to a clock (with a second hand) that was displayed prominently in the window of MTC's office, thus offering accurate time information to passers-by.[445]

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[442] 'Greenwich Time and Electric Telegraph', *Aberdeen Journal*, 7 July 1847, 6. (From the *Manchester Guardian*).

[443] 'Regulation of Time by the Electric Telegraph', *London Journal*, 7 August 1852, 344.

[444] The apparatus was designed by Mr R. L. Jones of Chester.

[445] On 11 February 1861, MTC counted 1,860 persons stopping by to compare the time displayed in the window with their watches or chronometers. 'Proposed Transmission of Greenwich Time from Glasgow Observatory', *Glasgow Herald*, 25 September 1863, 4.

The provision of time to the public did not always involve clocks and time balls. On 17 August 1863, for example, UPTC conducted an experiment to provide Newcastle with Greenwich Time by firing a cannon at exactly one o'clock. The time was provided by the astronomical clock located 120 miles away at the Edinburgh Observatory, in the form of an electrical signal generated by a device designed by Wheatstone and described by the *Newcastle Courant* as a magnetic explorer instrument (presumably similar in concept to the device in use at the Greenwich Observatory). Managed by UPTC's engineer Nathaniel Holmes, the project involved a private wire from the Observatory on Carlton Hill to Edinburgh's railway station, from which ETC then provided 'gratuitously' the long distance wire along the railway line all the way to Newcastle. It is not known whether the long distance wire was entirely dedicated to this application or assigned to it temporarily, but at exactly one o'clock on that Monday afternoon, the electric current generated at the Royal Observatory of Edinburgh discharged the 32-pounder cannon located in Newcastle – the first town in England with a time gun.[446] The following day, a second test was conducted, this time with another private wire extending the system from Newcastle to North Shields where a second 32-pounder gun had been installed. The success of this second experiment led to the adoption of the system. The Tyne Commissioners granted £200 a year for its maintenance, and the time guns thus became a permanent fixture of Newcastle and North Shields, as well as becoming a showcase for other towns.

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[446] 'Newcastle Time Gun'.

With the continued co-operation of Professor Piazzi Smyth, Astronomer Royal for Scotland, and the support of the Glasgow Town Council, Holmes launched a new experiment in that town.[447] Located near Renfrew Street in a site belonging to City Bank, the 32-pounder gun could also be heard a long way away. Here, a map of the city was produced to indicate the propagation time of the sound as it travelled outward from the gun location. Each concentric circle on the map represented one second interval. It showed, for instance, that the sound of the time gun was expected to be heard in the Exchange approximately two point five seconds after one o'clock, while for Glasgow College the delay was five seconds. The telegraphic wire from Edinburgh to Glasgow was provided this time by MTC, who had also provided a wire for another time gun in Sunderland.

The Edinburgh Observatory was thus controlling the time guns at Newcastle, North Shields, Glasgow and Sunderland via special wires. Not everyone was convinced of the adequacy of the time gun solution though. Mr Grant, Professor of Astronomy at the University of Glasgow, argued that the time gun was an imperfect solution for the dissemination of accurate time, and urged the Town Council of Glasgow to lay down a private wire from the Glasgow Observatory to control the city clocks.[448] Instead of a time gun controlled all the way from Edinburgh, he proposed that a time ball or a turret clock be remotely synchronised with the astronomical clock of the Glasgow Observatory to indicate the time at any specified hour of the day, or possibly make use of a clock with

[447] 'The New Time Gun', *Glasgow Herald*, 26 September 1863, 4.

[448] 'Proposed Transmission of Greenwich Time from Glasgow Observatory'.

a second hand to indicate the correct Greenwich Time every instant, as Liverpool had done a couple of years earlier.

As *The Times* reported on 30 September 1863, time accuracy was a matter of increasing importance, and it was regarded as 'a public benefit which ought to be retained'.[449] Electric (or galvanic) clocks regulated by electric current had been in existence since the 1840s. Alexander Bain and Charles Shepherd, amongst others, were known inventors of such 'sympathetic' clocks.[450] The ones installed in various rooms of the Greenwich Observatory in 1852, for instance, were designed by Shepherd, and similar clocks were also installed in various departments at the Post Office, as early as 1855.[451]

The popularity of electric clocks increased in the 1860s as clear economic advantages could be derived from them. *Fraser's Magazine* reported that a well-known stationery firm in London (possibly Waterlow & Sons) saved about £300 a year by installing clocks in its establishments, all synchronised with '*the horometrical prime mover in Flamstead House'*, in other words Greenwich Time.[452] The savings were chiefly the result of the elimination of the periods of grace which, previously, were necessary due to the uncertainty of timekeeping. With synchronised clocks, bells were now ringing in unison at the stated time, not only in and about the workshops, but also across all the establishments which had been interconnected with private wires. Citizens as well as

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[449] 'Time Gun for Glasgow'.

[450] On 2 June 1858, Charles Wheatstone also filed a patent for a clock which could synchronise its operation with a master clock via private wires (an 'electromagnetic telegraphic clock').

[451] Anon, 'Telegraph Time', 21.

[452] Ibid., 19.

businesses across the country – from railway stations to churches, town halls, workshops and even homes – in every town and soon in every village – benefited from more accurate clocks tuned to Greenwich Time, a benefit made possible by the immediacy afforded by the private wires.

> This electric instrument [‘the national time keeper or chronofer’] sends correct time to all the chief stations in Great Britain and Ireland at 10 a.m. when it is received from Greenwich.[453]

As the Post Office took over the private telegraphs, electric time currents became a priority, and new timekeeping services were offered to the public based on the signal provided by the Royal Observatory at Greenwich. As can be seen from the above extract, the chronopher located in the metropolitan room of the Post Office in Telegraph Street transmitted the signals to all the main post offices in the country, which then displayed Greenwich Time as a service for the public at no charge. For those who wished to have the ‘luxury’ of the electric time current at their places of business or their homes, the Post Office offered a comprehensive set of private services that also gave the ‘true’ Greenwich Time.[454] These services were part of the private telegraphs department since the signals were delivered via private wires.[455] The basic charges for such signals were initially set at £10 for the ten o’clock signal, and £25 for the one o’clock signal – the difference in rates being justified by the disruption to the ordinary telegram traffic caused by the latter, which also required specific arrangement and equipment at every

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[453] Wynter, ‘Postal Telegraphs’. There is no spelling mistake here: Wynter wrote chronopher with an ‘f’.

[454] ‘Observations as to Private Telegraphs’ 31 October 1870, Post 30/381B, BT Archives.

[455] ‘Time Signals (Letter from Engineer-in-Chief to Secretary)’ 10 November 1870, Post 30/253B, BT Archives.

station providing the service.[456] To these charges was added the cost of the private wire carrying the signal, at a special rate. In London, for instance, the minimum charge for the ten o'clock signal was £15 within a radius of two miles from the General Post Office, and £15 plus the standard rate of a private wire for any distance over two miles.[457] Elsewhere the charges varied from £12, including the private wire to the renter's house if it did not exceed one quarter of a mile, to £17 for a distance of one mile, with any distance beyond one mile charged at ordinary private rates.

This comprehensive set of time signal services reveals how the Post Office recognised the importance of timekeeping. Had it not been for the private wires, time signals would have been much too inaccurate because of the high latency of telegrams over the public network infrastructure. Accuracy was indeed needed to make such services trustworthy, and while users' trust in the 'sympathetic clocks' was an important consideration, it was not sufficient: the trust was also established by the private wires bearing the electric signals from the Greenwich Observatory.[458]

[456] These signals were also referred to as the one o'clock current and the hourly current. 'Private Telegraph Wires', *The Times*, 8 April 1871.

[457] In London, the majority of time signal wires were 50 to 300 yards long, and were sometimes used by small shopkeepers to save the expense of a transit telescope. 'Time Signals (Letter from Engineer-in-Chief to Secretary)'.

[458] Referring to users' trust or distrust in instruments [technologies], Gooday made the point that 'it might also be pertinent to consider what features of technologies such users might expect to be able to trust as this was not always co-extensive with their interest in the trustworthiness of technologies'. Graeme Gooday, *The Morals of Measurement - Accuracy, Irony, and Trust in Late Victorian Electrical Practice* (Cambridge University Press, 2004), 270.

5.5. From observatories to collieries

The same observatory had witnessed two decades earlier another use of private wires, or special wires to be exact. In this case, the special wires were used as an aid to measure longitudes. In 1851, Astronomer Royal George Biddell Airy established Britain's prime meridian at the Royal Observatory of Greenwich. Meanwhile, France was using the Imperial Observatory of Paris as its prime meridian.[459] Their precise measurement relative to each other was of great importance as they played a critical role in cartography.[460] In 1854, Airy and his peer in Paris (Mr Le Verrier) decided to experiment with the electric telegraph to determine the longitude of the two observatories. The idea was to observe and note the time given by a chronometer adjusted by astronomical means in both Greenwich and Paris – each operation being synchronised by an electric signal.[461]

The use of ordinary telegrams was, of course, inconceivable as they lacked the required immediacy. On the other hand, the cost of installing a private wire over such a long distance, especially across the Channel, would have been unjustifiable for this

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[459] The Greenwich meridian was only adopted in 1884 as the universal prime meridian at the International Meridian Conference in Washington D.C.

[460] The first measurements, in 1790, produced a result of 9 minutes and 20 seconds using geodetic triangulation techniques. This was followed by another campaign of measurements in 1821, 1822 and 1823, resulting in 9 minutes and 21.6 seconds. Anon, 'Nouvelle Détermination de La Longitude Entre Les Observatoires de Paris et de Greenwich Par Le Télégraphe Électrique', *Bulletin de La Société de Géographie (Paris)* 8, no. 4 (1854): 291.

[461] The series of tests which took place in May and June 1854 under the supervision of Messrs Faye (in Paris) and Dunkin (in Greenwich) resulted in the most precise value to date: 9 minutes and 20.63 seconds: A Boillot, *L'astronomie Au XIXe Siècle* (Paris: Didier & Co., 1873), 199. The first campaign of measurement lasted eighteen days and consisted of over 2,500 individual observations: Michael Kershaw, 'A Thorn in the Side of European Geodesy': Measuring Paris-Greenwich Longitude by Electric Telegraph', *The British Journal for the History of Science* 47, no. 175 (2014): 642.

application. This conundrum was resolved by the use of a special wire providing an end-to-end electrical circuit between the two observatories: an agreement was first sought with the South Eastern Telegraph Company to provide a connection between the telegraph station at Lewisham and the Observatory; and this was followed by another connection – this time with the wires linking London and Dover, then to the submarine cable linking Britain and the Continent, thus to the French telegraphic network. According to Kershaw, a 'simple brass switch' was installed in a 'locked iron box' for which Airy had the key, and it is assumed that a similar mechanism was installed in Paris. It was then simply a matter of reconfiguring one of the wires to create an end-to-end electrical circuit between the two observatories: a special wire – in effect, a private wire. As the measurements were taking place at night, the disturbance to public telegraphy operation over these wires would have been minimal.[462] Although, as Kershaw put it, measurement by telegraph was initially no more accurate than that by rocketry and chronometry some decades before, the accuracy of this basic tool for establishing simultaneity increased over the next half-century.[463] By telegraph, Kershaw of course alluded to private wires that observatories across the US and Europe employed for this type of scientific measurement.

The industrial world also made extensive use of private wires. The mining industry, for example, adopted private wires for both coal pit operation and general

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[462] It should be noted that the method for measuring longitudes by electric telegraph originated in North America. The first experiment took place in January 1849 between the observatories of Philadelphia, Cambridge, New York City and Washington, D.C., using an electro-chronograph designed by John Locke, an instrument-maker. Anon, 'Telegraph Time', 20.

[463] Kershaw, 'A Thorn in the Side of European Geodesy': Measuring Paris-Greenwich Longitude by Electric Telegraph', 658.

communication purposes. The UPTC ledger for the year 1869 contains several references to collieries, such as the entry for Swan Coates & Co., which owned the Ormesby and Salt Burn mines near Middlesbrough.[464] In a paper delivered in 1872 to the Chesterfield and Derbyshire Institute of Mining, Civil, and Mechanical Engineers, Arthur Radcliffe, a telegraphic engineer from Birmingham, mentioned that an increasing number of collieries were installing private wires.[465]

Reliable communication between workers was a key requirement in underground mining operations.[466] Electrical devices interconnected via a copper wire covered with gutta percha and inserted in a protective iron pipe were first installed for shaft operation. In some cases, the wire extended from the shaft head to the engine-house where an electric gong duplicated the signals received by the banksman, allowing the engine-man to control the engine without waiting for retransmission by the banksman.[467] Electric wires were also used on inclines (engine roads), where tubs were

[464] This entry shows a receipt for £104 for a telegraphic system in April 1869. 'UPTC Ledger 1865-1870', TGJ/2/1/2, BT Archives.

[465] Arthur Radcliffe, 'On the Advantages Derivable from the Employment of Electricity for the Purpose of Underground Signalling', *Transactions of the Chesterfield and Derbyshire Institute of Mining, Civil, & Mechanical Engineers*, 1872.

[466] The person responsible for managing the operations from the shaft head was the banksman, and the person at the bottom was the hanger-on. The banksman had to wait for the agreed signal from the hanger-on, the man running the tubs in and out of the cages down in the pit, before hoisting up the load. In this harsh and noisy environment, loud audible signals were the only way of drawing attention and sending messages. A signal line known as the knocker line extended down the shaft, and a mechanism consisting of a lever bar and metallic plate (the knocker) was installed at the stationary engine and at the bottom of the shaft, allowing communication to take place by striking the plates according to a coded sequence of knocks. Moreover, the repair of a broken knocker line usually proved difficult.

[467] At the Tapton Colliery the signals were transmitted up the plane and shaft into the engine-house, so that the engine-driver could receive his signals direct from the bottom of the plane, a distance of upwards of 2000 yards. Radcliffe, 'On the Advantages Derivable from the Employment of Electricity for the Purpose of Underground Signalling', 7.

being pulled along the plane via a rope haulage system powered from a stationary engine. Such wires were bare galvanised iron to enable the electrical devices that replaced the mechanical knockers to be brought in contact with the line as and when required to signal the engine driver from anywhere along the roadway.[468] It was not uncommon for a knocker line to reach 1,000 yards and physically pulling the line to operate the knocker at the other end required significant effort, especially when the communication required many knocks. The adoption of 'electrical knockers' was a great improvement in this regard.[469] It was also more reliable and easily repaired when broken, thus improved the safety and efficiency of the mining operation.[470]

The private wires were not restricted to underground operations. Collieries, like firms in other sectors, had traditionally employed messengers to convey business correspondence. From the mid-1860s, however, the messengers were increasingly being supplanted by private wires. In a letter to Radcliffe, Mr Edmonds, the Managing Director of the Varteg Hill Colliery near Pontypool, described the benefits of such wires:

> Referring to the Electric Signal you fixed for this Company for working our railway incline, I have pleasure in saying that it has answered the purpose admirably. The little line of Signal from the colliery office to the coal pits (1 mile) also assists in expediting the dispatch of traffic.[471]

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[468] Frederick Danvers Power, *Coalfields and Collieries of Australia* (Melbourne: Critchley Parker, 1912), 102.

[469] It will be seen in the next chapter that collieries eventually replaced 'electric knockers' with telephones, which solved the problems of anonymity of the telegraphic signals. Michael A. Kay, 'Inventing Telephone Usage: Debating Ownership, Entitlement and Purpose in Early British Telephony.' (Unpublished Thesis, University of Leeds, 2014), p. 69.

[470] Productivity, according to Radcliffe, was improved by at least one-third. Radcliffe, 'On the Advantages Derivable from the Employment of Electricity for the Purpose of Underground Signalling', 8.

[471] Ibid., 13.

Perhaps Mr Edmonds was amongst the colliery proprietors in the Swansea region who, in 1878, rented an ABC instrument and a private wire for private business communication. As we saw earlier in this chapter, unlike the direct point-to-point private wires seen in Chapter 4, these wires were terminated in the Swansea post office. There, depending upon the electric signals initially received, an operator could either answer the call with his own ABC instrument, or switch the line to one of the 10 subscribers also connected to the Swansea exchange with ABC instruments of their own.[472] These were the early days of switchboards – devices which would play a critical role in the ensuing years, for telegraphy and telephony, as we shall see in the next chapter.

5.6. Conclusion

The evidence presented in this chapter serves to reinforce the importance of private telegraphy in the history of the Victorian telegraph. The Post Office was reluctant at first to take over the private wires. Once UPTC was acquired, however, a Surveyor of Private Wires was appointed – a decision which, by itself, indicated that private telegraphy was to be treated differently from public telegraphy. The Surveyor of Private Wires managed an independent business unit within the Telegraph Department and promoted actively the business of private telegraphy. Not only did the private wires enable a broad range of services, they were also a source of profitable business – a perspective ignored in past narratives of the telegraph.

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[472] Kingsbury, *The Telephone and Telephone Exchange, Their Invention and Development*, 84. Other customers at the time included Grenfell & Sons (Copper Works) and Vivian & Sons (Copper Works). 'Swansea: ABC Intercommunication Telegraph System' 1881, Post 30/392C, BT Archives.

Private wires or special wires were employed when telegrams could not provide the level of immediacy required by certain applications, or when the volume of information transmitted over the wires would have impacted the traffic of telegrams or been impacted by it. The private wires were an enabling technology and a source of innovations, with applications ranging from private communication between two subscribers (seen in Chapter 4) to bulk transmission of press messages or the diffusion of time signals. Like the private wires, the special wires were also socially constructed: it was the lobby of newspapers that saw the press wires being built from wires that were shared with the public during the day, and dedicated to a specific newspaper at night. Fast instruments operated over such wires which stretched between towns several hundreds of miles apart, and the conversion from iron to copper in the mid-1880s increased further the efficiency of these long distance lines, with recorded speeds in excess of 400 words per minute for the Wheatstone Automatic. Like the newspapers, the provincial stock exchanges lobbied the Post Office for private wires. However, the stock exchanges did not have the same level of influence over the Post Office as the press and often struggled to make their case for stock wires, especially as these wires were required during the day when public telegraphy operation was at its peak.

The private wires had first demonstrated their usefulness by ensuring the safety of railway operations in the late 1830s and early 1840s, and more than thirty years later they remained a critical component of the widely adopted block system.[473] Indeed, the

[473] Cooke was the primary instigator of the experiments at the Great Western and Blackwall railways. The paper he wrote in 1842 described how the safety of the trains operating on single lines could be improved with the electric telegraph. It was equivalent, he said, to providing the engine driver with a 'bird's-eye' view of the line from station to station. His vision led

versatility of private wires increased considerably over time. Some were even laid in hostile environments, such as the one installed between Fort Williams and the meteorological station at Ben Nevis, or the one laid across the Firth of Forth in connection with the building of the new bridge – for both telegraphic and telephonic communication purposes.[474]

Like the wire laid for the construction of the Forth bridge, it is to short private wires that our attention must turn to again. Earlier in this chapter I wrote that the subscribers of the Swansea exchange were amongst the first in Britain to experience the benefits of a telegraphic switching facility, made possible by switchboards. I will explore further this critical technology in the following chapter as it was critical to the development of exchange telephony by the Post Office. Moreover, the private wires used in those telegraphic switching facilities, as well as the ones employed for direct communication between ABC instruments, played an important role in the development of the telephone. In the late 1870s and early 1880s, the subscribers who had purchased or rented ABC instruments were given the opportunity to connect a telephone on the

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eventually to the development of the block system 'by which trains are kept apart upon the same line of rails by a certain and invariable line of space'. Unlike the earliest wires which mixed train signalling between stations with general communications, and could thus be construed as public telephony, the block system dedicated the private wires to train signalling using different makes and types of instruments to display the 'line clear' and 'line blocked' signals. The term 'block', explained William Preece, 'is an unfortunate choice of word: it was introduced through the practice of "blocking" or pinning the telegraph needle over in the earlier instruments used to work the system. The "space" system in opposition to that of "time" would have been more accurate; but the word "block" has now become so thoroughly rooted in the railway language that it would be difficult to supplant it.' It is also interesting to note that the one-wire block system was the inspiration behind the use of private wires in underground mining operation discussed earlier in this chapter. William Fothergill Cooke, *Telegraphic Railways* (London: Simpson, Marshall & Co., 1842). Preece, 'On the Block System of Working Railways', 233. Radcliffe, 'On the Advantages Derivable from the Employment of Electricity for the Purpose of Underground Signalling', 4.

[474] 'Thirtieth Report of the Postmaster-General on the Post Office', 1884. 5.

same line – some used the telephone in addition to their ABC instrument, others replaced it altogether. The dual use of these private wires during the early days of telephony in Britain accelerated the development of exchange and private telephony, as we shall now see.

Chapter 6. The Assimilation of Private Wires

In this chapter, I demonstrate that the Post Office played an important role in the development of exchange telephony, due to the prior existence of private wires and its previous involvement with telegraphic intercommunication systems. As part of this demonstration, I examine the relationship between the private wires, the ABC and telephone instruments, and the nascent switchboard technology.[475]

Intercommunication between renters of ABC instruments was made possible by the use of switchboard technology. It was by substituting ABCs with telephones, connected over the same private wires leading to a reconfigured intercommunication system, that the Post Office established its first telephone exchange. Here, I explore how this telephone exchange came about, and how this technology enabled the Post Office to compete with the private telephone companies during the first few years of telephony. During this period, which lasted to the mid-1880s, the private wires were progressively assimilated by telephony, and became known as subscriber lines.

The chapter begins with a broad perspective that covers the early days of telephony and the conduct of the Post Office in response to this disruptive innovation. This narrative is followed by an insight into the first operational telegraphic intercommunication system in Newcastle – a system which the Post Office would use as a model for its future telephone exchanges. The chapter then changes its regional focus

[475] A switchboard (an electrical switch built around a frame) was a piece of apparatus that made or broke electrical connections between telegraphic or telephonic lines. In telegraphy, it was originally referred to as an intercommunication system.

to Swansea, where it explores the challenges faced by the Post Office as it attempted to deploy its first telephone exchange, based on the hitherto seen intercommunication technology.

The first section ('**from speaking telegraphs to telephones**'), offers a history of the early days of telephony in Britain, from 1877 to 1884 – a short but critical period, where the public discourse on telephony increasingly overlapped with that of telegraphy. This narrative emphasises the role of the Post Office, and forms the foundation for the next two sections. As transpires from this narrative, the Post Office had a complex, evolving association with the telephone. Its first, almost instinctive, reaction was to protect the telegraph, but the Telegraph Department soon realised the futility of this response and treated the telephone as an opportunity, as well as a threat. This ambivalence was reflected in its policies towards the private telephone companies, which the Post Office regulated and at the same time competed against. Here, then, I counter Kieve's view that the Post Office prevented the development of telephony.[476]

In the second section ('**the politics behind the Umschalter**), I introduce the intercommunication systems that would evolve into, and subsequently become for a few years, the technology behind the telephone exchanges operated by the Post Office, before being replaced by more efficient switchboards. The origin of these systems is traced back to the operation of UPTC in Newcastle, the private telegraph company featured in Chapter 4. Also called 'Umschalters' or 'universal switches', these intercommunication systems were initially used with telegraphic lines and private wires,

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[476] According to Kieve, the Post Office deliberately hindered the development of the telephone. Kieve, *The Electric Telegraph*, 214.

before being converted into telephone exchanges. Telephone historians have not tended to question this period of transition and the role played by the Post Office in the development of exchange telephony, but rather focused on the private companies and on a technology imported from America. My inquiry into this period produces important missing elements in the historiography of the telephone – elements linked to the politics behind the Post Office's first generation of telephone exchanges.

In the third section ('**the dual use of private wires'**), I explore the chaotic events that led to the opening of the first telephone exchange operated by the Post Office in the Swansea district on 23 March 1881, and the dilemma faced by the renters of ABC instruments as the Post Office and the Swansea Telephone Company competed for their custom. I show that the prior existence of private wires was an important factor in the final decision made by these renters, as such wires could carry both telegraphic and telephonic communications; although their dual use would also cause major concerns for the Telegraph Department because of interference issues.

6.1. From speaking telegraphs to telephones

'Yesterday afternoon', reported the *Daily News* on 13 July 1877, 'about one hundred gentlemen assembled at the Queen's Theatre, Long Acre, on the invitation of Mr Cromwell F. Varley to witness a private preliminary trial of his telephone, or musical telegraph, by means of which sounds of variable pitch can be conveyed from one place to another by electricity'.[477] Two weeks later, on 28 July 1877, *The Graphic* published another article on the 'Speaking Telegraph', and on 18 August 1877 *The Times* reported

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[477] The *Daily News* had reported on 9 March 1877 an earlier account given by the *Boston Daily Globe* on the state of the telephone.

(by telegraph, from Plymouth) the account given the previous day by William Preece during the convention of the British Association for the Advancement of Science: he had just returned from Boston where he had 'conversed through wires 32 and 24 miles long'.[478] The chairman of the convention, Sir William Thomson (later Lord Kelvin), went on to say that he had met himself with the inventor of the telephone, Alexander Graham Bell, who had arrived the previous day in Glasgow to run a series of experiments in his laboratories.[479]

Bell had made his discovery nearly two years earlier – a discovery the origin of which was later contested in a patent dispute. Indeed, as Arapostathis and Gooday pointed out, in about 1860 the German craftsman and school teacher Philipp Reis had built a device that 'to some degree communicated the human voice'.[480] Nevertheless, in early 1876 Bell was able to talk through his instrument and be clearly heard by Thomas A. Watson, his assistant, in another room in the house where he conducted his research.[481] Elisha Gray had also been working on similar experiments for the Western Electric Company, a subsidiary of the powerful Western Union Company, but Bell had beaten him to the U.S. Patent Office and was awarded a patent for his 'speaking

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[478] 'The British Association', *The Times*, 18 August 1877, 6.

[479] Sir William Thomson was first introduced to the telephone in 1876 during a visit to Philadelphia where he met Alexander Graham Bell. He subsequently exhibited Bell's telephone at a meeting of the British Association for the Advancement of Science in Glasgow in September 1876. Thomson was quoted to say of this invention to be the "greatest by far of all the marvels of the electric telegraph". William H. Preece, 'Recent Progress in Telephony', *Nature - A Weekly Illustrated Journal of Science* 26, no. 673 (21 September 1882): 516.

[480] See section 4.2: 'Philipp Reis's unpatented *Telephon*: A preemption of Bell or mere musical toy?' in Arapostathis and Gooday, *Patently Contestable*, 95.

[481] Anon, *The Story of a Great Achievement: Telephone Communication from Coast to Coast* (New York: AT&T, 1915), 1.

telegraph'.[482] Later, in 1877, Thomas Edison patented the carbon microphone, the device that was to become an integral part of the combined telephone instrument offered by the United Telephone Company and its subsidiaries after the merger of the Bell and Edison interests in 1880. Commercialisation of the Bell system in the US began in May 1877 when a young entrepreneur providing security services to banks in the Boston area proposed to his clients to use the wires already installed between his office and the banks' premises for telephonic communication purpose by day and restore them to a burglar-alarm telegraphic system by night.[483]

In the UK, Bell, represented by Morgan Brown, filed a patent on 9 December 1876, before selling five-eighths of it for five thousand dollars in 1877 to an American businessman called Colonel William H. Reynolds of Providence, Rhode Island, who later, in June 1878, formed 'the Telephone Company' to acquire and work Bell's patent – the first telephone company to operate in Britain.[484] Preece wrote on 19 September 1877 that he expected 'the demand for the instrument [to] be very considerable', but that in its present form the telephone presented no threat to public telegraphy, although it could possibly be used in private wire installations where an ABC instrument was currently employed.[485] This was indeed the case, at least until the end of 1879, as can

[482] The patent number 174,465 was issued to Bell by the U.S. Patent Office on 7 March 1876. It was called 'An Improvement in Telegraphy'. Herbert N. Casson, *The History of the Telephone*, Tenth Edition (Chicago: A. C. McClurg & Co., 1922), 33.

[483] Ibid., 53. Five banks were connected to a crude 'telephone exchange' switch in Mr. E. T. Holmes's premises in Boston.

[484] Arapostathis and Gooday, *Patently Contestable*, 89. Casson, *The History of the Telephone*, 246. Mr James Brand was the first chairman of The Telephone Company. Kingsbury, *The Telephone and Telephone Exchange, Their Invention and Development*, 193.

[485] 'Preece's Report to Graves' 19 September 1877, Post 30/603B Part 2, BT Archives.

be seen in advertisements from the Telephone Company (see Figure 6.1. below), although one important reason for this, as Kingsbury pointed out, might have been that ‘the Bell magneto telephone by itself was not powerful enough for general use as an exchange instrument’.[486] Consequently, the department entered into a negotiation with Reynolds to distribute telephones, despite an earlier comment to the contrary by Postmaster-General John Manners in the Commons.[487] The reasoning of the Post Office at the time was that since telephones would only be used with private wires, it would be advantageous for the Department to protect its private wire business by pre-empting demand for such devices. The deal negotiated between Reynolds and the Engineer-in-Chief of the Post Office, Mr Edward Graves, on 5 December 1877 called for a payment of £3 per annum for each rented telephone, which represented a discount of forty per cent over the price to the public.[488] As was usual for any unplanned expenditure, the Postmaster-General sought approval of the deal from the Treasury. However, the Treasury withheld its consent until 31 May 1878, just at the time the Telephone Company was being formed.[489] On 24 July of that year, a letter from Mr Morris, the solicitor of the Telephone Company, was received by the Post Office, which rejected the deal made earlier between Reynolds and Graves. There followed a protracted negotiation between the Post Office and the Telephone Company to supply the government with telephones. As this negotiation was taking place, two more telephone

[486] Kingsbury, *The Telephone and Telephone Exchange, Their Invention and Development*, 193.

[487] ‘I do not propose to introduce it [the telephone] in that branch of the Postal Telegraph Service’ said Manners. ‘Postal Telegraph Service - The Telephone Question’ (HC Deb Vol 238, 21 February 1878).

[488] ‘Mr Graves’ Report’ 5 December 1877, Post 30/603B Part 2, BT Archives.

[489] ‘Early History of the Telephone - Digest of the Official Papers’, Post 30/542 Part 2, BT Archives.

companies were established: the first was the Edison Telephone Company of London, incorporated in August 1879 to work Edison's patents, and the second was the Lancashire Telephone Exchange Company, set up to work Bell's patents in Manchester and its vicinity.[490] The entry of all these private telephone companies into the market raised many questions at the Post Office with regard to its telegraph business. Undeniably, the servicing of the public debt resulting from the acquisition of the private telegraph companies was secured by the profits to be generated by the telegraph service – not by imposing a burden on the taxpayer. At least this was the theory, because the telegraph had yet to generate a single profit.

The Post Office also realised that telephone exchanges, as planned by the private telephone companies, could seriously interfere, not only with its profitable private wire business, but also its much larger telegrams operation. Yet, at the same time, the Post Office did not want to put a stop to 'what [could] perhaps prove to be a public convenience' as long as the rights of the Crown and the public revenue were protected.[491] In September 1879, a new policy was devised by the Post Office and sanctioned by the Treasury, which called for the companies to operate under the terms of a licence. At first, the companies refused to take out a licence because, during the negotiation of the Telegraph Act, 1878, the extended definition of the term 'telegraph' proposed by the Post Office had been rejected by the House of Commons.[492] However,

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[490] Hemmeon, 'The History of the British Post Office', 219.

[491] 'Telephones (in Folder: Protection of the Postmaster General's Rights Regarding the Introduction of the Telephone, 1879-1881)', Post 30/398 (file no. 1), BT Archives.

[492] Clause 3 of the proposed Act of 1878 read initially: 'The term telegraph in addition to the meaning assigned to it by that Act shall include any apparatus for transmitting messages or other communications with the aid of electricity, magnetism, or any other like agency'. The

the Post Office eventually found an answer to this argument in a new interpretation of the Telegraph Act, 1869, where in section 3 of that Act, the term 'telegraph' was defined as 'any apparatus for transmitting messages or other communications by means of electric signals'. Messages were now to be understood as being of a telegraphic or telephonic nature, therefore extending the monopoly already granted for the transmission of telegraphic messages to the telephone service. Still believing that they were in the right, the companies challenged the legality of the new interpretation, arguing that the telephone was a new invention and could not be subject to the telegraph monopoly, and therefore refused to apply for such a licence.

The Telephone Company had been, until this point in time, visibly promoting private, point-to-point telephony across the country, as can be seen in the advertisement below, but it was now also establishing telephone exchanges.[493]

proposal passed the Lords but was defeated in the House of Commons because it was felt that this Act would confer to the Post Office a monopoly on telephonic communication without properly compensating the entrepreneurs who had introduced the system and invested in its development in the UK. 'Postal Telegraph Department' (HC Deb Vol 3, 29 March 1892).

[493] A detailed research into private, point-to-point telephony has been done by Michael Kay. Kay, 'Inventing Telephone Usage'.

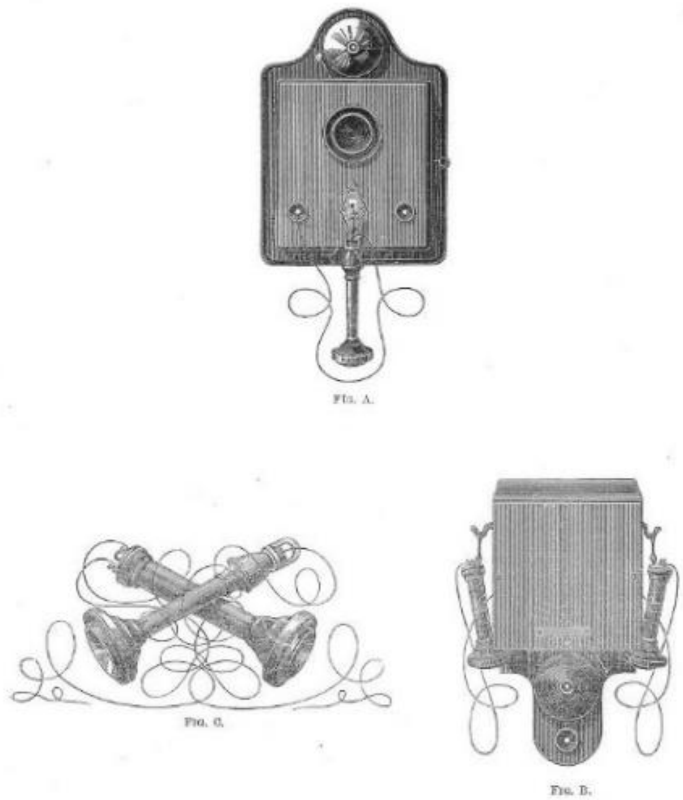

Figure 6.1. From an advertisement by the Telephone Company, dated 20th October, 1879. These telephones were not to be used 'in connection with a Telephonic Exchange, but only for private lines or for domestic purpose'.[494]

By November 1879, the Telephone Company had three telephone exchanges in London, with 142 subscribers each paying twenty pounds per year.[495] An advertisement in *The Times* on 21 January 1880 stated that 'telephonic lines of every description, rental or otherwise' could be erected to connect subscribers to the central stations at 35 Coleman Street and Leadenhall House. The company also operated six provincial

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[494] 'Private Telephony Advertisement' 20 October 1879, Post 30/402, BT Archives.

[495] 'Telephone Exchanges for the Metropolis (in Folder: NTC Agreements and Royalties)' 27 November 1879, Post 30/402, BT Archives.

exchanges in Manchester, Liverpool, Glasgow, Birmingham, Sheffield and Bristol.[496] In January 1880, legal proceedings were initiated by the Attorney-General on behalf of Manners who, meanwhile, had issued directives to postmasters to 'be careful and report any steps that may be taken for the establishment of telephone exchanges'.[497] He was also resisting independent initiatives by renters to replace their ABCs with telephones.[498] Still, the Post Office looked favourably on works of public interest on the part of the companies. On 5 March 1880, for instance, it granted permission to the Edison Telephone Company to lay private wires between the offices of two newspapers, *The Times* and the *Daily News*, and the House of Commons, for the transmission of private voice communications.[499] As we saw in Chapter 4, UPTC had also installed private wires between the House of Commons and the newspapers (as well as the Queen's printer Eyre & Spottiswoode), but the wires then had been terminated by ABC instruments instead of telephones.

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[496] A prospectus for a proposed telephone exchange in Leeds indicates that the Telephone Company and its affiliates had already acquired in excess of 800 subscribers in various parts of the country by August 1880. The cost of the subscription was £12 per annum, including the cost of installation and instruments, and of all the communications, local or otherwise, irrespective of distance. 'North & Sons Prospectus (in Folder: NTC Agreements and Royalties)' 13 August 1880, Post 30/402, BT Archives.

[497] 'Injunction to Restrain the Edison Telephone Company and the Telephone Company', *The Times*, 21 January 1880, 4. 'Letters from the Secretary of the Post Office to the Leeds and Bradford Postmasters (NTC Agreements and Royalties)' 6 August 1880, Post 30/402, BT Archives.

[498] In a letter to the editor in *The Times* of 22 August 1879, for instance, R.P. from Tunbridge Wells complained that the Post Office refused to exchange his ABCs with telephones (following his own successful independent test of the instruments), asking him instead to pay an additional £11 for the supply of the two telephones (in addition to the ABCs rental), while refusing, as an alternative, to adjust the existing rental agreement to the private wire only. 'To the Editor' 22 August 1879, Post 30/398 (file 10), BT Archives.

[499] 'Grant to the Edison Telephone Company (in Folder: Protection of the Postmaster General's Rights Regarding the Introduction of the Telephone, 1879-1881)', Post 30/398 (file no. 13), BT Archives.

To strengthen their position in the market, as well as benefiting from the combination of their respective technological strengths, in May 1880 the Telephone Company and the Edison Telephone Company amalgamated under one company called the United Telephone Company (UTC).[500] The response to this development by the Post Office was not long in coming. Stevenson Arthur Blackwood, the new Secretary of the Post Office, like Rowland Hill and Frank Ives Scudamore before him (but unlike John Tilley whom he replaced in May 1880), was a fervent supporter of State intervention. Under his influence, the newly appointed Postmaster-General Henry Fawcett, a liberal and former professor of political economy, wrote to the Treasury on 10 December 1880:

> I propose then that the Post Office should at once establish a telephone exchange system of its own, and leave the companies no time to set up vested rights and a practical monopoly.

Was he anticipating the results of the legal proceedings initiated by Manners? On 20 December 1880, the Attorney-General ruled in favour of the Crown.[501] In its judgement, the court held that 'a telephone [was] a telegraph', and UTC was thus infringing on the monopoly of the Post Office, because it could only operate telephone exchanges under licence at the discretion of the Postmaster-General, as per section 5 of the Telegraph Act, 1869.[502] The terms of the three-year licence proposed by the Post

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[500] The Telephone Company controlled Bell's US patent for the 'transmission of undulatory currents corresponding to the aerial vibrations produced by speech': a magneto receiver which produced weaker sounds than the Edison Company electro-chemical receiver, but was more practical than the latter. Kingsbury, *The Telephone and Telephone Exchange, Their Invention and Development*, 192–200.

[501] According to Holcombe, the company argued that the telephone, unlike the telegraph, did not transmit an electric signal but a human voice – rather a weak argument which must surely have been easily defeated, leaving the Attorney-General with no recourse but to acknowledge that the telephone was indeed under the monopoly of the Post Office. Arthur N. Holcombe, 'The Telephone in Great Britain', *Quarterly Journal of Economics* 21, no. 1 (November 1906): 99.

[502] 'Judgement in Favour of the Crown' 20 December 1880, Post 30/398 (file no. 1), BT Archives.

Office severely restrained an exchange operation within a half mile radius and, in addition, required the payment of a fixed royalty of £100 per year in addition to the payment of twenty five per cent of the gross profits.[503] The terms also prevented two or more exchanges to be connected together (as this would have interfered with the local message business of the Department), although there was no limit imposed on the number of exchanges within the area.[504]

Seizing the ruling opportunity, Blackwood recommended to Fawcett that telephonic communication should be offered to private wire subscribers, and that telephone exchanges should be established, where appropriate. The goal of this new policy was to create a competition between the Department and the companies – a competition designed to prevent a repeat of the telegraph situation which had put the companies in a dominant position during the negotiation for their acquisition. Blackwood's plan was to offer private wire subscribers a choice between an ABC instrument and a telephone, and to this end, he sourced the telephones from Frederick A. Gower who held his licence from the Telephone Company to use Bell's patent (such telephones were referred to as the Gower-Bell loud speaking telephones – see Figure 6.2. below). In response, UTC claimed exclusivity on all the telephone patents in the UK,

[503] 'Postmaster-General to the Lords Commissioners of Her Majesty's Treasury' 12 September 1879, Post 30/398 (file no. 1), BT Archive.

[504] In a later version of the licence, the royalties paid to the Crown were to be between ten and twenty per cent of the gross amount of every subscription: a disincentive to build large exchanges as the higher rate was targeted at the subscribers the furthest away. For instance, the maximum radius was set at four miles for London, while for Bradford it was set at two miles. 'UTC Agreement (in Folder: NTC Agreements and Royalties)' 30 January 1880, Post 30/402, BT Archives.

including those instruments that the Post Office intended to offer to its subscribers.[505] With the Post Office holding firm on its interpretation of Gower's licence, the situation forced the two parties to resume negotiation.[506] New terms were announced: the licence was now valid for thirty one years from the end of 1880, although it was subject to a possible termination after ten, seventeen or twenty-four years, that is at the end of 1890, 1897 and 1904. Also, a new radius was agreed for each major town ranging from one and a half to five miles. Fawcett believed that with the royalty set at ten per cent of gross receipts, any negative impact on the telegraphs would be offset by this new income from the telephones.[507]

> Hitherto it has been practically a monopoly in the hands of a private company, who hold the controlling patents, and of the Post Office, who possess the controlling power, but this monopoly has been broken, and we are about to witness severe competition.[508]

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[505] UTC claimed a monopoly on all telephone patents in the UK, including the Gower-Bell telephones that the Post Office intended to provide to customers. Gower had acquired the licence from the Scott & Wollaston Company that held a licence to use Bell's patent from the Telephone Company. He had also added an improvement of his own on to the Bell's instrument transmitter. Although the licence specified that Scott & Wollaston could not establish telephone exchanges, it did not specify that one of their customers was also prevented from doing so ('Postmaster-General to the Treasury: Question of the Establishment of Telephone Exchanges by the Department' 10 December 1880, Post 30/542 Part 1, BT Archive.). Moreover, as Arapostathis and Gooday pointed out, the claim for exclusivity (by UTC) was weakened by the "alleged prior disclosure " of Bell's telephone by Sir William Thomson at the September 1876 BAAS meeting in Glasgow. Arapostathis and Gooday, *Patently Contestable*, 94.

[506] UTC had also filed for patents infringement of the Edison transmitter but on 21 January 1881, the three attorneys retained by the Postmaster-General returned their opinion: the Gower-Bell telephone did not constitute an infringement of the Edison patents and proceedings could not be successfully taken by the proprietors to prevent its use. 'Opinion on Case' 21 January 1881, Post 30/542 Part 2, BT Archives.

[507] 'Indenture (in Folder: NTC Agreements and Royalties)' 26 April 1881, Post 30/402, BT Archives.

[508] Preece, 'Recent Progress in Telephony', 516.

While the Treasury had consented to let the Postmaster-General offer a telephone service to give him leverage to negotiate the licences with the companies, the Lords Commissioners had also understood this new service to be of limited scope. Fawcett (and behind him Blackwood), however, interpreted the Treasury's response as an agreement to proceed with the implementation of a telephone service 'in a wide and comprehensive manner' across the country, where the companies had not yet established a presence. Preece's statement, above, reflected this understanding throughout the Post Office. The Treasury had also agreed to Mr Gower's offer to purchase 5,000 telephones at retail price less a reduction of twenty five per cent, and authorised the expenditure of £50,500 for building telephone exchanges and additional private wires.[509]

A few days after receiving the Treasury's consent, the Post Office placed advertisements in the major newspapers to 'meet the convenience of the public by providing either the ABC or the telephone instrument'. On 28 January 1881, Graves wrote to Fawcett that the Department had received 50 applications for the establishment of 'systems of telephonic intercommunication'.[510] At the end of 1881, however, UTC had already acquired 1,338 subscribers in London alone, while making significant progress elsewhere in the country – for comparison purposes, as of 31 March 1882 the Post Office had acquired 177 subscribers in the entire country, 598 during the

[509] The cost of the Gower-Bell telephone set for the Post Office was £9 (from a public price of £12), plus £1 for the battery. The Post Office calculated the rental price at £4 per annum.

[510] 'Telephone Intercommunication - Immediate Action to Be Taken (Graves to Fawcett)' 28 January 1881, Post 30/542 Part 1, BT Archives.

following year, and had 954 subscribers as of 31 March 1884.[511] From this position of relative strength, UTC attempted to interconnect its telephone exchanges to extend the reach of its network, via the establishment of so-called trunk lines – in effect, private wires that carried voice traffic between subscribers connected to different exchanges. Breaching the terms of the licence, this attempt was met by a categorical refusal on the part of the Post Office, which agreed instead to manage the trunk lines on the condition that their rent be paid directly by the company's subscribers.[512] Further restrictions were imposed, and this led to much criticism of the Post Office.[513] The conduct of the Post Office, *The Times* wrote at the time, 'although not legally dishonest, was morally indefensible'.[514] Speaking in the Commons on 22 May 1884, Fawcett stated that he acted as the trustee of the public in regard to the £10 million of taxpayers' money expended for the acquisition of the telegraphs – an investment now threatened by the relative success of the telephone. His policies were often perceived as restrictive and

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[511] 'Number of Telephones in Use for Telephone Exchange Purposes during Each Year since the Post Office Commenced Telephone Exchange Business' 12 May 1884, Post 30/542 Part 1, BT Archives. Arthur Hazlewood, 'The Origin of the State Telephone Service in Britain', *Oxford Economic Papers* 5, no. 1 (1953): 14.

[512] The trunk lines were initially to be charged to the companies at an annual rental of £10 per double wire plus one half of the revenue the companies would charge subscribers for trunk communication. However, when the Lancashire & Cheshire Company decided to offer trunk communication free of charge to their subscribers, the Post Office then imposed on each subscriber a charge of 10s. per mile for trunk line usage. 'Trunk Lines' (HC Deb Vol 288, 22 May 1884).

[513] The new licence imposed restrictions such as Article 3 (no written messages to be conveyed) and Article 4 (no messages to be collected or delivered). 'Indenture' 29 November 1884, Post 86/14, BT Archives.

[514] 'Post Office Interferences', *The Times*, 13 June 1884, 9.

even sometimes prohibitive towards the companies, which by then included the London & Globe Telephone Company and UTC's six regional subsidiaries.[515]

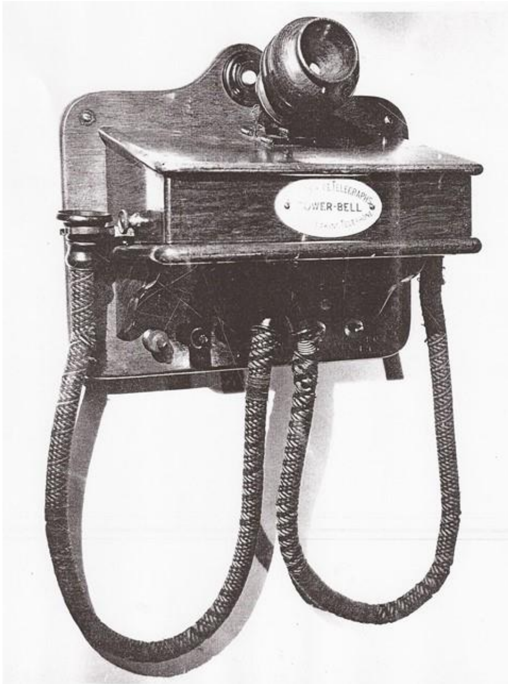

Figure 6.2. A Gower-Bell loud speaking telephone, circa 1881. Source: BT Archives.

This situation was aggravated by the unwillingness on the part of some local authorities to grant wayleave powers to erect poles, or run wires above or underground. To resolve the situation, some voices were already calling, through letters and newspapers, for the take-over of the telephone companies, but Fawcett was more inclined towards free competition amongst the companies and between the companies and the Post Office. On 7 August 1884, he announced a plan to de-regulate the trunk lines.

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[515] The six regional companies were: the National Telephone Company, the Lancashire & Cheshire Telephone Exchange Company, the Northern District Telephone Company, the Telephone Company of Ireland, the Western Counties & South Wales Telephone Company and the South of England Telephone Company. Hazlewood, 'The Origin of the State Telephone Service in Britain', 16.

Under the new scheme, new licences would be issued to allow the companies to operate their trunk lines, as long as they were restricted to voice communication. The growth of the interurban voice traffic followed. There were still calls for the nationalisation of the telephones, however, as the telephone companies were having significant issues obtaining wayleaves for their wires. At best the municipalities were driving hard bargains, and it was not uncommon for local authorities to refuse these rights altogether. Consequently, the companies resorted to installing the wires above ground, knowing full well the risks of interference with other electrical apparatus, especially the telegraph lines. For every new subscriber, a new wire was frequently strung from the house top to the central office, either from roof to roof or using posts that supported many other subscriber wires. Indeed, the overhead wires had become a public nuisance, although more unsightly than hazardous.[516]

But if the wires (or subscriber lines as they were now called) were a challenge for the companies, the Post Office had also its own challenge: the telephone exchanges. As I explain in the next section, the companies operated a technology imported from America. Meanwhile, in its determination to open telephone exchanges throughout the country to compete with the companies, the Department chose a different technology – one of European origin, and which had been used initially in telegraphic intercommunication. The reason for choosing this technology was politically motivated, as the Post Office needed to prove to the Treasury that, like the companies (and

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[516] In its conclusion, the Select Committee which considered the law relating to the control over telephone and telegraph wires said that the risk of danger to the public from overhead wires had been greatly exaggerated; and accidents had been proved in evidence to have been few and insignificant. 'Report from the Select Committee on Telephone and Telegraph Wires', 12 May 1885.

independently from them), it was capable of delivering exchange telephony to the public.

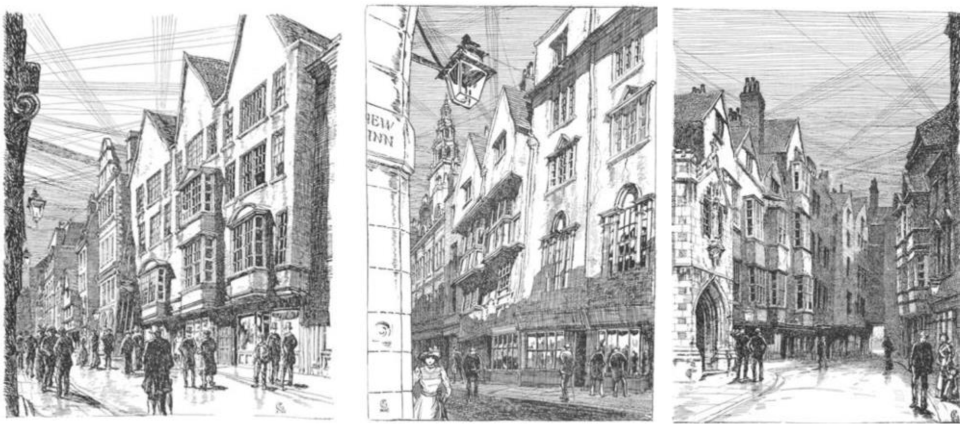

Figure 6.3. 'The hideous criss-cross of electric wires overhead': Illustrations of Fetter Lane, Wych Street and Cloth Fair Alley in London.[517]

6.2. The politics behind the Umschalter

> To establish a telephone exchange system in other towns would therefore simply be to extend a system which the department has already had in operation for several years, the only difference being that telephones would be used instead of ABC instruments.[518]

Switchboards were first introduced in telegraphy during the early 1860s, and their importance grew with the introduction of telephony in the late 1870s. As we shall see in this section, switchboards were, for all intents and purposes, an extension of private wires. At the turn of the twentieth century, Thomas F. Purves and John E. Kingsbury traced the development of this technology but, as engineers, they were more inclined to concentrate on its technical features rather than its social construction. Later,

[517] E.T. Cook, *Highways and Byways in London* (London: Macmillan & Co., Ltd., 1902), 148, 159.

[518] 'Postmaster-General to the Treasury: Question of the Establishment of Telephone Exchanges by the Department'.

telephone historians never questioned the politics behind this technology and failed to recognise the two paths of development that existed between 1881 and 1884 – the first adopted by the Post Office, and the second by UTC.[519] The failure to identify this multi-directional development and to report on the first (unsuccessful) path resulted in a Whig history of switchboards: telephone historians assumed that the technology adopted by UTC necessarily followed from the past, or perhaps they overlooked the first path simply because it did not prevail in the long term. As the epigraph implies, the Post Office developed its own switchboard technology – a technology, as we shall see below, that was technically inferior to the one employed by the companies. However, this technology served also a political purpose – to paraphrase the title of a work from Langdon Winner, it seemed to 'have politics'.[520]

In this section, I show that this technology was created by reconfiguring a telegraphic switchboard into a telephonic switchboard, in effect giving it a new meaning. However, beyond this social construction the technology was also manipulated to suit a political purpose – if only for a few years, the Umschalter had the power to influence

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[519] Kieve, for instance, ignored the role of the Post Office as an operator of telephone exchanges (emphasising instead its role as a regulator), while Perry acknowledged the fact that the Post Office ran telephone exchanges but did not go any further and avoided the technology question. It must be noted, however, that Kay pointed out that the Post Office telephone exchanges were small and more expensive compared to those of the telephone companies. Kay, 'Inventing Telephone Usage', 149, 170. Perry, *The Victorian Post Office*, 152. Kieve, *The Electric Telegraph*, 204.

[520] I am referring to: Langdon Winner, 'Do Artifacts Have Politics?', in *The Social Shaping of Technology*, 2cd ed. (Buckingham: Open University Press, 1999), 28. First published in: Langdon Winner, *The Whale and the Reactor - A Search for Limits in an Age of High Technology* (The University of Chicago Press, 1986), 19. However, the case of the Umschalter was entirely different that the bridges of Long Island given as an illustration by Winner. The Umschalters did not exclude social groups from telephony nor did they create varying power relationship between telephone users. Here, the technology simply underpinned the political aim of the Post Office.

political decisions. Initially, the Treasury, as far as telephony was concerned, had been in favour of letting market forces play out without government intervention. I explain why the Treasury relented and let the Post Office carry out its plan – that of becoming an exchange telephony operator.

Let us now examine in more details this (relatively) short lived telephone switchboard technology.

The telephone switchboard technology initially developed by the Post Office was based on a telegraphic intercommunication system commonly known as the Umschalter. The reference to 'Umschalter' implies a Germanic origin, a term used interchangeably with 'universal switch' in Britain by contemporaries.[521] In France, the technology was referred to as 'commutateur Suisse', and indeed there are vague references to the firm of Messrs Gustav Hasler and Albert Escher in Bern where German was and continues today to be the official language.[522] Aristide Dumont is also mentioned by Kingsbury as one of the earliest designers of telegraphic switches, although his British patent of 1851 for a telegraph exchange was purely conceptual and related to his vision of a city-wide hierarchical telegraphic architecture, as proposed for Paris in 1850 (see footnote 298 in Chapter 4).[523]

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[521] This 'Universal Switch' (telegraphy) should not be confused with the 'Universal Switch' (telephony) developed by the Western Electric Company and commercialised from 1879. For this reason, the term 'Umschalter' will be preferred.

[522] Hasler & Escher bought the "Atelier fédéral de construction des télégraphes" created in 1852 by the Federal Council. E. Lacroix, ed., 'La Telegraphie', *Nouvelle Technologie Des Manufactures, Des Mines, de l'Agriculture, Etc.* (Paris, 1872), 403.

[523] Kingsbury, *The Telephone and Telephone Exchange, Their Invention and Development*, 78.

From 1861, ETC employed an Umschalter in York to connect on-demand (thus temporarily) to telegraph offices for the transmission of telegrams.[524] This 'through-switching' device was also used in London, Manchester and Leeds.[525] The switching of lines allowed messages to 'be continuously transmitted from one city to another without stoppage or re-writing at the central office', therefore eliminating transcription errors and speeding-up the delivery of telegrams.[526]

The next time we hear about an Umschalter is in 1864, when UPTC found a practical use for it in Newcastle, one of the four regional telegraph offices set-up by the company (see Chapter 4). Here, it allowed one operator with a single ABC instrument to serve the three private wires rented by the firm of Sir William Armstrong, a significant engineering firm involved in hydraulics and gun manufacturing (and later in the building of warships, in co-operation with the firm of Charles Mitchell & Co): the first one for the Elswick works, another one going to Blyth, and the third one to Chester-le-Street.[527]

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[524] Kingsbury and Purves made reference to 1854 as possibly the first time a telegraph switching system was used, but neither of them provided a source for this information. During my research, I came upon two letters from Mr Heaviside (25 November 1889) and Mr Mosley (19 December 1889), in response to a question asked by the Secretary of the Post Office who wanted to confirm that a telegraphic intercommunication was established in Newcastle by UPTC in 1866. Heaviside was employed by UPTC in Newcastle from 1861, appointed district secretary in 1864. Mosley appears to have been one of the UPTC engineers in Newcastle at the time. 'Letter from Mr Heaviside' 25 November 1889, Post 30/542 Part 2, BT Archives. 'Letter from Mr Mosley' 19 December 1889, Post 30/542 Part 2, BT Archives.

[525] Thomas F. Purves, *Telegraph Switching Systems* (London: Gatehouse & Co, 1902), 2.

[526] Anon, 'Lewis's Permutating Telegraph Switches', *The Telegraphic Journal: A Weekly Record of Electrical Progress*, 14 May 1864, 230.

[527] 'Letter from Mr Heaviside'. See also 'Armstrong, William George, Baron Armstrong' (1810–1900), armaments manufacturer and industrialist by Stafford M. Linsley in the *Oxford Dictionary of National Biography* at http://www.oxforddnb.com/view/article/669, last accessed on 30 November 2015.

By the time UPTC was transferred to the Post Office, 35 lines were connected to that switch, and by 1872 the Post Office required the connection of a further 25 lines (in total 40 renters and 20 post offices).[528] This meant finding space to accommodate additional ABC instruments in the Newcastle telegraph office, which would have required expanding the premises or renting a new and more spacious office. Instead, Colin Brodie (by then Surveyor of the Private Telegraphs at the Post Office) engineered the Umschalter to support 60 lines, while reducing at the same time the number of instruments to be installed in the telegraph office to 15.[529] The system was operational in 1873. Here, in Newcastle, space optimisation was thus another benefit afforded by the Umschalter.

Many of the Newcastle subscribers were collieries, located a long distance away from the town and they found it more convenient to connect private wires to the telegraph office rather than use the service of a messenger to carry telegrams. With their private wires and ABC instruments, renters could send telegrams to the telegraph office, to be forwarded either by telegraph or by post as ordinary letters or by special messengers. If forwarded by post, the renters had to pay one penny, and if forwarded by messenger the renters paid threepence if within the limits of ordinary free delivery of telegrams.[530] This was the original purpose of these private wires. In 1878, the Newcastle telegraph office began to offer an intercommunication service in addition to

[528] Kingsbury, *The Telephone and Telephone Exchange, Their Invention and Development*, 83. (Information furnished by Mr Colin Brodie).

[529] Purves, *Telegraph Switching Systems*, 4. F.G.C. Baldwin, *The History of the Telephone in the United Kingdom* (London: Chapman and Hall, 1925), 122.

[530] 'Intercommunication System - Form E - Private Wires - Articles of Agreement' 1 January 1879, Post 30/542 Part 1, BT Archives.

the telegram service. This was referred to by the Post Office as 'Intercom' and 'Work' services: not only could subscribers send and receive telegrams through their ABC instruments ('Work'), they could also be connected on-demand with other renters ('Intercom').

The way an Umschalter performed an Intercom operation was relatively straightforward. Put simply, the system consisted of 'two series of insulated metal bars fitted at right angles to each other, each bar of one series crossing all the bars of the other, with connection between these bars made by means of metal plugs inserted through and in contact with both bars at the crossing point'.[531] A Swiss commutator was thus a matrix switch formed by these overlapping metal bars, with the private wires connected to one of the series (see Figure 6.4. below).[532] The metal plugs (or pegs) made a connection between the bars at any intersection.

The configurations of the Umschalters were not uniform but, typically, the private wires were connected to the switch via ABC receivers (also called indicators), and then through the switch to the earth. As can be seen in Figure 6.4., a call bell was also included to attract the attention of the operator (equipped with a short circuit to disable it during busy periods). If the call was for the operator – indicated by a repetition of a code, as seen on the receiver for that particular line – the operator switched into circuit one of the available complete ABC instruments to communicate with the caller. If the call was for another subscriber, the caller was connected to the latter on the switch, but only

531 W.H. Preece and J.S. Sivewright, *Telegraphy*, New Edition (London: Longmans, Green & Co, 1914), 180.

532 William Preece used the term Swiss commutator (rather than Umschalter) in a later work. William H. Preece and Arthur J. Stubbs, *Manual of Telephony* (London: Witteker & Co, 1893), 179.

after activating a pole changer to ensure that the two remote ABC instruments were correctly electrically polarised – the pole changers (or reversing switches) being in circuit with each line. With such a system, there was therefore no need to mirror the renters' ABC instruments which were configured on the Newcastle Umschalter. The configuration chosen at the time was one ABC instrument for every three subscribers, for a total of 15 ABCs.[533]

This configuration represented a saving of 30 instruments – a significant saving, both in cost and in space. Moreover, in my opinion, the three-to-one ratio between renters and ABCs connected to the Umschalter also indicates that the Intercom facility was rarely used at this stage, as connecting a renter with another renter would have taken much less time to execute than the transmission or reception of a telegram. A higher usage of the Intercom facility would have thus permitted an even higher ratio and further savings. The main purpose of the Newcastle Umschalter in 1878, therefore, is likely to have been for Work services. In other words, it was seldom used for connecting renters together.

As can be seen in Appendix 3, Newcastle was not the only town with an Umschalter, nor was it the first one: four other towns operated such a system by 1877 or 1878, including Swansea as we shall see in the next section. These five towns were joined by 12 others in 1880, the same year that saw Blackwood's new policy sanctioned by the Treasury.

[533] It is not known how Engineer Colin Brodie arrived at this conclusion, but it can be assumed that statistics were available from previous operation with 35 subscribers. It should be noted that Mr Agner Erlang did not produce his traffic measurement formula (queuing theory) until 1909.

While space saving may have been a consideration, the main justification for deploying all these Umschalters was to provide telegram services, and later on call switching between renters of ABC instruments. The flurry of new installations in 1880 can also be linked to Blackwood's new policy, that is, an anticipation of their conversion into telephone exchanges as I explain below. And indeed, from 1881 as we shall see in the next section, Umschalters were employed to switch ABC instruments as well as telephones connected via private wires.

But the 60 Umschalter installed in Newcastle was near its practical physical limitation. Umschalters were indeed unable to cope with a large number of lines because they required, proportionally, an increasing amount of horizontal space on the front of the switchboards. This was the main reason why the Post Office eventually replaced Umschalters by another type of switchboard developed originally in America by the Western Electric Company. In 1878, the American District Telegraph Company (the same company that provided urban telegraphy in New York City a decade earlier, as we saw in Chapter 4) opened a telephone exchange in Chicago using this technology, and so did the Telephone Company in London as early as 1879.[534] These switches offered a much larger subscriber capacity, while at the same time being more efficient at handling the calls.[535]

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[534] 'The Exchange System of the Telephone Company' 12 November 1879, Post 30/398 (file no. 2), BT Archives. Edward Graves visited the office of the Telephone Company on 7th November 1879 in the company of Mr Preece, and produced a report that described the telephone switchboard in use in the exchange. These telephone exchanges started operation in the US as early as 1878. In London, this technology was used in the Bell exchange in 1879. Kingsbury, *The Telephone and Telephone Exchange, Their Invention and Development*, 178.

[535] Edward Graves reported to the Postmaster-General on 12 November 1879 the visit of William Preece's visit to the Telephone Company exchange. According to him, the telephone exchange

Although there were many different versions, the Western Electric Company switches operated generally on the following principle: subscriber lines were brought to the switchboard (sometimes called a switch frame), each subscriber being identified individually by a number. As for an Umschalter, the subscriber lines passed first through an indicator. However, the subscriber lines were arranged on the switchboard in a tight formation, horizontally as well as vertically, and connected to small sockets called jacks. The operator was then able to establish an interconnection between any two lines by inserting short flexible cords (metallic circuits) with a plug at the ends to fit into the appropriate jacks.[536] A call was initiated by sending a current from the caller's telephone set (from the local battery or the magneto, depending upon the model) to the central office, which caused a small disc to fall suddenly, thus identifying the caller visually on the switchboard. The operator then connected his (or her) phone to the caller to get the name of the called subscriber, before placing the two subscribers in communication with each other.

The Western Electric Company technology, however, was not initially chosen by the Post Office. Politics was an important factor behind this decision: Fawcett and

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of the Telephone Company that William Preece inspected on 7 November 1879 was configured for 55 subscribers, but the switchboard was prepared for 150 wires (subscribers). 'The Exchange System of the Telephone Company'.

[536] A jack (or spring-jack) was a little switch set into the switchboard and consisting of two metal springs connected to the subscriber line (there also were different types of jacks, such as the jack-knife switch). When the plug was inserted, the tip and the sleeve of the plug engaged with the two springs to complete the connection. The device was invented by Charles E. Scribner, an engineer at the Western Electric Company. The first model created by Scribner in 1878 was called a jack-knife; it used metallic pin and screw sockets. Frederick Leland Rhodes, *Beginnings of Telephony* (New York: Harper & Brothers, 1924), 149. Herbert Laws Webb, *The Telephone Service - Its Past, Its Present, and Its Future* (London: Witteker & Co, 1904), 37. Kingsbury, *The Telephone and Telephone Exchange, Their Invention and Development*, 175. Casson, *The History of the Telephone*, 144.

Blackwood were determined to 'leave the companies no time to set up vested rights and a practical monopoly', but the Treasury had been reluctant to let the Post Office venture into telephony and had to be convinced. In his letter to the Lords Commissioners of Her Majesty's Treasury on 10 December 1880, Fawcett argued that the Department should be allowed to open telephone exchanges across the country in order to establish authority and negotiate with the telephone companies in a satisfactory manner for licences.[537] The establishment of such telephone systems, he further argued, would come at low incremental cost as these would be the systems of telegraphic intercommunication already established in several towns. Fawcett was, of course, referring to the Umschalters in operation – those that were already providing a telegraphic intercommunication facility between renters of ABC instruments. The response from the Treasury was received on 16 December 1880; in addition to allowing the Post Office to compete with the telephone companies 'to a limited extent', it also authorised the purchase of 5,000 telephones from Mr Gower.[538] It is on that basis that the Post Office proceeded with the deployment of telephone exchanges. Umschalters had thus been instrumental in winning the argument and establishing a new government policy: the provision of exchange telephony to the public.

Apparently, the public supported this plan: 'There can be no doubt', wrote Fawcett, 'that the public would very much deal with the Post Office rather than with

[537] 'Postmaster-General to the Treasury: Question of the Establishment of Telephone Exchanges by the Department'.

[538] The Treasury authorised £37,500 for the purpose of establishing a telephone exchange system and a further £13,000 for ordinary private wire purposes. In addition, it authorised the acceptance of Mr Gower's offer for 5,000 telephones. 'Reply from the Treasury' 16 December 1880, Post 30/542 Part 1, BT Archives.

private companies'. As we shall see in the next section, this was partly true as, while many renters stayed loyal to the Post Office and gave it ample time to establish a telephone exchange and supply them with telephone sets, others were not as patient and threatened to cancel their ABC subscriptions and join the local telephone company.

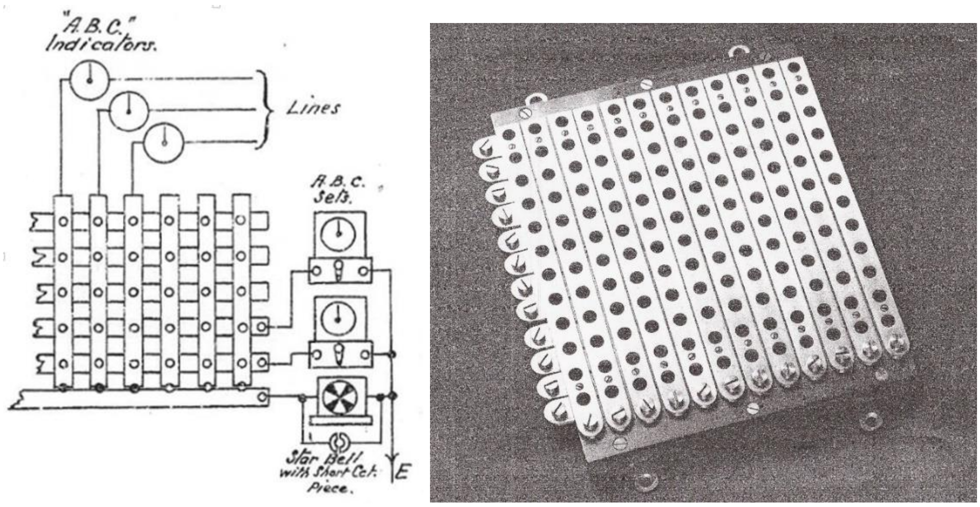

Figure 6.4. The universal switching capability of the Umschalter can be seen here (left) under one possible configuration of the switch (Source: diagram extracted from T.F. Purves, Figure 3). The picture on the right is an actual twelve-line Umschalter dating from 1880 (Source: BT Archives)

The eventual demise of the Umschalter, as a telephone switchboard, was due to its physical limitation and operational complexity. Purves stated that the Umschalters continued in practical operation until 1884, although it is likely that some went on for a few more years, before being replaced by the jack-based switchboard technology. Nonetheless, it is roughly during this period, that is, between 1881 and 1884, that two competing telephone exchange technologies coexisted – one championed by the Post Office, the other by the telephone companies.[539]

In effect, the Post Office gave a new meaning to the Umschalter when the telegraphic intercommunication system was transformed into a telephone switchboard. In doing so, the Post Office achieved a political objective, that of providing exchange telephony to the public and, ultimately, preventing a private monopoly.[540]

Let us turn our attention now to the first users of this technology: the renters of private wires and ABC instruments of the Swansea district.

6.3. The dual use of private wires

As mentioned in the first section of this chapter, Graves' memorandum to Fawcett on 28 January 1881 mentioned that the Department had received fifty applications for the establishment of 'systems of telephonic intercommunication'. The Swansea Post Office had sent one such application and, on 23 March 1881, it became the first post office in the country to operate a telephone exchange.[541] In this section, I explore the

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[539] It is likely that some telephone companies may have experimented with Umschalters or similar matrix systems before adopting jack-based switchboard, but no evidence could be found to that effect.

[540] The National Telephone Company (the amalgamation of UTC with its subsidiary companies) had nevertheless achieved by 1911 a dominant position, a quasi-monopoly, with 561,000 subscribers, while the Post Office in the same time had only acquired 120,000 subscribers in total. Hazlewood, 'The Origin of the State Telephone Service in Britain', 23.

[541] 'Experiments with the Telephone at Swansea', *Western Mail*, 8 December 1877, 3. In 1877, point-to-point telephony experiments had been conducted between two police stations in Swansea.

challenges faced by the Department as it introduced telephony to renters of ABC instruments in this district.[542]

Swansea, not unlike Newcastle, was a provincial town in the midst of a mining district. The first telegraphic intercommunication service in this town opened on 7 October 1878, and by February 1881 it numbered seventeen subscribers, with three more on the waiting list. We learn from the local engineer, Mr D. Snell, that the subscribers included: the Swansea Zinc Ore Company, the Hafod Copper Works, the Poingdestre & Mesnier Company (ship brokers and exporters of coal), the Middle & Upper Bank Copper Works, Vivians & Sons (a copper smelter), Grenfell & Sons (another copper smelter), Bath & Sons, the Mining Office, James Strick & Sons, Ford & Company, the Swansea Harbour Trust (for communicating with the lighthouse on the outer islet of Mumbles Head) and the Lloyds Agency.[543] As we saw in Chapter 4, the directors of UPTC had predicted in 1865 that 'the prospects amongst the coal proprietors of Newcastle, South Wales and other mineral districts were encouraging', and indeed many companies on that list were related to the mining industry.

All these customers rented ABC instruments, connected to the intercommunication system via private wires. The correspondence between Snell and Brodie in early 1881 shows that the Swansea Post Office was asked by the Department to approach renters to assess their desire or need to migrate from telegraphy to

[542] The following account is based on primary sources as well as John Kingsbury's interview of Sir John Gavey who was, in 1878, the Superintending Engineer of the Swansea post office.

[543] See correspondence between Snell and Brodie: 'Swansea: ABC Intercommunication Telegraph System'.

telephony. At the time, the Swansea Telephone Company, an independent telephone company established a few months earlier, had not yet opened their telephone exchange and, in line with Blackwood's policy, the Department was free to launch a telephone exchange if it succeeded in finding a sufficient number of subscribers.[544]

In his response to Brodie on 10 February 1881, Snell confirmed that, in January of that year, and with a few exceptions, all the renters were anxious to replace their ABCs with telephones.[545] Many of them wanted to stay loyal to the Post Office, a few were indecisive and others were already in discussion with the telephone company. Mr Charles Bath (from the firm of Bath & Sons) was also the chairman of the Swansea Telephone Company, and it is not surprising that his firm chose that company. But so did, apparently, Vivians & Sons, Ford & Co, Poingdester & Mesnier, James Strick & Sons and the Harbour Trust – however these firms were also discussing separately with the Post Office the replacement of their ABCs with telephones. Indeed, the Swansea Telephone Company and the Swansea Post Office were locked into a competition as to who would get the most expressions of interest (if not promises of subscription) for their respective telephone exchanges. As Snell wrote to Brodie on 15 January 1881:

> The telephone people are working hard here but I have stopped their little game in several places. I find it, however, uphill work for they had the start on us and they are doing their work cheaply.[546]

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[544] The Swansea Telephone Company (or Swansea Telephonic Exchange Company) was created in October 1880 and sold to the Western Counties Telephone Company in April 1887. As pointed out by Kay, these small local companies such as this one provided 'a different vision for the future of British exchange telephony'. Kay, 'Inventing Telephone Usage', 172. See also: 'Transfer of the Swansea Telephone Company', *Western Mail*, 5 April 1887, 2.

[545] 'Swansea: Conversion of Certain Private Wires to Telephones' 1881, Post 30/392C, BT Archives.

[546] The Postmaster-General had set an annual charge to each telephone renters of £14. 10s. for premises within half mile of the telegraph office, £18 if not more than one mile, and at

Some renters were more cautious than others about the reliability and usability of telephones, and decided to keep their ABC instrument, in addition to getting a telephone. Amongst them were those who stayed loyal to the Post Office (at least until the expiry of their rental agreements), and thus they needed only one private wire (a single line) because switches would be installed in both their premises and the telephone exchange to allow a convenient swap between the telephone and the ABC. Those who were considering going to the private company needed, of course, two separate private wires from their premises, the first to the Telegraph Office and the second to the Telephone Company. The added cost of this second private wire would have been an incentive to stay with the Post Office.

There were also renters like the Swansea Zinc Ore Company who, on 5 February 1881, withdrew their application for a telephone because the companies they were hoping to communicate with, in this case Grenfell & Sons and Vivians & Sons, were (apparently) going with the telephone company.[547] Moreover, the firms which had expressed a preference for the Telephone Company were still discussing the replacement of their ABC instruments with the Post Office. Poingdestre & Mesnier, for instance, asked Snell to 'place in [their] office a telephone in lieu of telegraph as early as possible', while the Harbour Trust wanted to know when telephonic communication could be established between their office and Mumbles Head. Others, like the Mining

proportionate rates for greater distances (these rates included the telephone and the service). The comment made by Snell highlights the competitive nature of the business. Indeed, the Telephone Company had more competitive rates: in July 1881, these rates were £10 for half a mile. Kay, 'Inventing Telephone Usage', 175. 'By Order of the Postmaster-General' December 1880, Post 30/542 Part 2, BT Archives. 'Swansea: ABC Intercommunication Telegraph System'.

[547] 'Swansea: Conversion of Certain Private Wires to Telephones'.

Office or the Lloyds Agency, would only commit to replacing their ABCs with telephones after receiving or seeing proof that telephonic communications could be carried out properly.

As can be seen above, the situation was rather chaotic. Additionally, Snell had made a commitment to supply telephones – a commitment still unfulfilled because the Gower-Bell telephones were still being procured (see section 6.1).[548] This put the Swansea Post Office at a disadvantage vis-à-vis the Telephone Company. Snell wrote to Brodie on 10 February 1881:

> ... the agents of the Telephone Company are working very hard and unless we can supply the same kind of instrument it is no use trying to do further business in Swansea.[549]

In truth, there would have been no point in supplying the telephones at this time anyway, since the telephone exchange was not yet operational. This telephone exchange, as we shall see below, was proving a challenge as the Department raced against time to set it up before the telephone company could establish their own. Mr Gavey, the superintending engineer of the Swansea Post Office captured the essence of this race when he wrote to Brodie on 28 February 1881:

> I take it that the object in hurrying the change at present is to admit a successful competition with the Telephone Company, but obviously this is impossible unless we can accommodate the additional renters we might obtain.[550]

Indeed, the Swansea Post Office was at the time operating a 20-bar Umschalter onto which the seventeen current ABC subscribers were connected via private wires.

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[548] Ibid. 'We may be glad to know when we may expect to have our telephone…' wrote the Hafod Copper Works on 8 February 1881; 'Please place in our office a telephone in lieu of telegraph as early as possible…' wrote Poingdexter & Mesnier on 9 February 1881.

[549] Ibid.

[550] Ibid.

With the three additional subscribers who had already been accepted, the switch was therefore at full capacity. Gavey estimated that a 30-bar Umschalter would be needed to accommodate all the renters – those keeping their subscription as it was, those exchanging their ABCs for telephones, and those having both ABCs and telephones connected to a single private wire. However, time constraints made this solution impossible because manufacturing a new 30-bar Umschalter would take too long and cost £80, thus necessitating Treasury approval. There was, however, an old 12-bar Umschalter available in the Cardiff Post Office depot which, although missing the pegs, could be made available in just a few days. Pending the procurement of a 30-bar Umschalter, Gavey proposed to Brodie to dedicate the 12-bar Umschalter to ABC renters, and reconfigure the 20-bar Umschalter for the telephone renters, including those that had ABCs, although he had doubts about mixing telephones and ABCs on the same poles, as we shall see below. Brodie eventually approved this proposal and initiated the requisition for a 30-bar Umschalter for the 'Swansea telephonic intercommunication system', which was approved by the Treasury on 9 March 1881. On 23 March 1881, the 20-bar Umschalter was inaugurated and became the first telephone exchange operated by the Post Office.[551]

The records show an annual rental of £22 10s. from Vivians & Sons, which had decided by then to stay with the Swansea Post Office. In the lower Swansea Valley where the smelting works and mills of the company were located, there was a telephone, presumably a Gower-Bell instrument (£4) and an ABC set (£6), together with a two-way

[551] Baldwin wrote that a second similar telephone exchange was opened in Cardiff on 31 August 1881, followed by another one in Newcastle in March 1882. Baldwin, *The History of the Telephone in the United Kingdom*, 126.

switch (10s.) to switch between the telephone and the ABC, as well as an electric current reverser for the ABC (10s.). The main office of the firm had only a telephone (£4). In the Swansea Head Telegraph Office (H.T.O.), where the telephone exchange was located, the following equipment was dedicated to Vivians & Sons: two telephone indicators with two bars on the switch (£3 10s.), and one ABC indicator with one bar on the switch (£4). This company alone, therefore, was monopolising three bars on the 20-bar Umschalter. It is interesting to note that the head office of the firm only made use of the telephone, while the smelting works and mills were able to switch between the telephone and the ABC, as and when required – an indication that while the head office had quick and easy access to the Swansea telegraph office to send a telegram as a contingency in case of telephone failure, the factories in the valley had to fall back on the ABC instrument to contact the head office via the telegraph office (and perhaps also to communicate with third parties). Grenfell & Sons had a similar configuration, although in their case they only rented a telephone and an ABC in one location (for a total of £17 5s.). To these prices, of course, had to be added the cost of the private wires which, in the country, was £3 up to half mile, £7 up to a mile, and at proportionate rates for greater distances.[552]

[552] For London, the cost of private wires was, by then, £4 for up to half mile, £8 for up to a mile, etc. The higher price reflected the complexity of wiring in the Metropolis which was mostly underground. Clerk services were eventually added to the annual rental of telephones. 'By Order of the Postmaster-General'. Later, a bundle was proposed, with an all-inclusive cost of £14 per annum for the rental of a telephone up to half mile, and £18 for a distance of up to a mile (outside London). The Post Office, however, requested a five year commitment which many businesses were reluctant to agree to. 'The Proposed Telephone Exchange for Derby', *Derby Mercury*, 6 July 1881, 5.

The dual use of private wires, as carriers of both telegraphic and telephonic communications, gave the Post Office a competitive advantage but also a significant technical challenge. Gavey wrote to Brodie on 28 February 1881 that he was worried about mixing ABCs and telephones on the same poles.[553] However, he had no choice but to accept the situation because the rental of a second private wire (on different poles) would have been a financial disincentive for existing renters, as well as putting the Post Office in parity with the telephone company (both requiring the laying of a private wire dedicated to telephony). In effect, the existing renters imposed the dual use of private wires. As a result, when a renter switched to telegraphic communication, the powerful currents (in the shape of square waves) produced by his ABC instrument interfered with the wires that ran alongside on the same poles, reducing significantly the quality of voice calls for other renters.[554] Moreover, early private wires were single circuits with an earth return. These worked satisfactorily under ordinary conditions, but induction phenomena could interrupt conversations at busy periods or under specific weather conditions, causing the renters to switch to telegraphic communication, thus compounding the problem. To reduce the inductive effects and eliminate the effect of earth currents, the Post Office eventually resorted to adding a separate return wire, but the telephone exchange in Swansea in 1881 did not benefit from this improvement.[555] It is ironic that steel wires were still largely employed during this period when Swansea was the world's largest producer of copper. Indeed, the Post Office did not provide

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[553] 'Swansea: Conversion of Certain Private Wires to Telephones'.

[554] The first generation of Gower-Bell telephones, whether magneto or battery operated, also offered low quality voice calls.

[555] William H. Preece and Julius Maier, *The Telephone* (London: Witteker & Co, 1889), 127.

telephone subscribers with the benefit of copper wires, with their greater electrical properties, until later.

Despite all these challenges, the Post Office succeeded in establishing in Swansea its first telephone exchange – a policy instrument justified previously to the Treasury as a means of preventing a practical monopoly on the part of the telephone companies. This policy, it should be stressed, was never intended to hinder the development of telephony, as illustrated by the situation in the Swansea district: while the local post office was competing with the Swansea Telephone Company for the acquisition of telephone subscribers, the Postmaster-General gave permission to the directors of the company to connect their telephone exchange to the local telegraph office.[556] Such a connection allowed their subscribers, for an additional annual subscription of £5 5s. to transmit 'inland and foreign telegrams' to the telegraph office by telephone. The Postmaster-General was thus giving the private company the ability to compete on an equal basis with the local post office telephone exchange.[557]

The successful establishment of this first telephone exchange was a milestone for the Post Office, and many more were to follow. This success, however, could not have been so easily achieved without the advantage afforded by the existing installed base of renters of ABC instruments and their private wires – even though the dual use of such

[556] 'The Telephone Exchange', *Western Mail*, 5 November 1881, 3. See also the previous day's edition.

[557] This offer on the part of the Post Office, however, may not have been as magnanimous as it appears: the additional fee of £5 5s. would have made the subscription to the Swansea Telephone Company more expensive than the one from the Post Office, especially for subscribers located at shorter distances from the telephone exchange.

private wires, for both telegraphy and telephony purposes, was also a source of concerns.

6.4. Conclusion

The relationship between the Post Office and the telephone between 1877 and 1884 was ambivalent and complex. The initial reaction of the Post Office was to protect the rights of the Crown to servicing the debt from the telegraph, and the first policy towards the telephone companies in September 1879 severely restricted usage of the telephone. Yet at the same time, the Post Office did not want to put a stop to what could prove to be a public convenience. The companies' attempt at isolating the telephone from the telegraph was met by the Attorney-General's ruling in favour of the Postmaster-General in December 1880, holding that a telephone was indeed a telegraph and that the companies would be infringing on the monopoly of the Post Office if they operated telephone exchanges without a licence. With this ruling, the Postmaster-General (Henry Fawcett at the time) was thus confirmed as the regulator of the telephone industry, and licences were issued. Moreover, Fawcett also anticipated that the Post Office would acquire the companies at some point in the future and was intent on not letting a private monopoly develop, as it would undermine the Crown's negotiating position during this second nationalisation. Therefore, Fawcett saw the establishment of Post Office telephone exchanges, in competition with the companies, as a way to strengthen the Post Office position on future negotiations. A patent dispute arose, settled eventually under the terms of new licences. Next, with the approval of the Treasury, the Telegraph Department set about to deploy telephone exchanges. The Post

Office was now a regulator and an operator – both judge and party in the nascent telephone industry.

To justify to the Treasury the Department's competency in matters of telephony, and switchboard technology in particular, Fawcett cited the telegraphic intercommunication facilities operated in several towns for the benefit of renters of ABC instruments, and their similarity with telephone exchanges. The technology employed in such systems was based on the Umschalter, a relatively simple switchboard that used a matrix formed by overlapping bars, which had been in use since the 1860s. In 1878, an Umschalter configured for sixty lines was employed in the Newcastle telegraph office, mostly to provide renters with the ability to send and receive telegrams, although some interconnections (between renters) were also taking place. Similar Umschalters were operated in other towns, and they became the Department's technology of choice for telephone exchanges. Meanwhile the telephone companies had selected a jack-based switchboard technology from the Western Electric Company which offered significantly more capacity, as well as a more efficient way to handle telephone subscribers. Hence, two very different exchange technologies existed during a period which lasted approximately from 1881 to 1884: one chosen by the Post Office for political reason, and based on the Umschalter technology, and a second used by the private telephone companies under licence from the Western Electric Company. In the end, the Umschalter technology did not prevail, but it allowed the Post Office to successfully implement its telephone exchange plan, and in this way limit the effects of the telephone private monopoly.

Swansea was one of the fifty Post Office towns which applied to the Department for a telephone exchange, having operated an Umschalter since 1878. On 23 March

1881, it become the first operational Post Office telephone exchange. The months leading to this noteworthy event in the history of the Post Office saw a chaotic competition between the local private telephone company (independent from the United Telephone Company) and the Swansea Post Office for the establishment of a telephone exchange in this town. Several factors were considered by the potential telephone subscribers, not the least the reachability of other subscribers. In the end, though, it was the ABC instruments and the dual use of the private wires that gave the Post Office the advantage. Many renters were reluctant to part from their reliable ABC instruments, and unwilling to pay for a second line to operate the instruments of the telephone company. The renters of ABC instruments exerted a strong influence on the Post Office for the dual use of private wires, although this set-up raised significant concerns within the Department in regard to the quality of the service. Indeed, the use of a single private wire to carry, on-demand, either telegraphic or telephonic communications brought with it interference issues that would only be resolved, later, with the segregation of telephonic and telegraphic wires, and the use of more advanced cabling technology.

Chapter 7. Conclusions

> The Post-office, industrious and effective as it is, will find an active rival standing by its side—bidding against it for popularity, coming in to share its message-carrying trade.[558]

> On 20 December [1880], an important decision of the Exchequer Division of the High Court of Justice defining the rights of the Department in connection with telephones was given against the companies which had established exchanges. As, however, they were apparently under the belief that they had infringed no law, I concluded an agreement which while protecting the interests of the public, afforded reasonable advantages to the companies concerned. The system of telegraphic intercommunication is therefore now being extended partly through the agency of companies and partly by the Post Office. The Department is in course of completion of telephonic intercommunication systems at Swansea, Glasgow, Greenock, Hull, Manchester to Liverpool, Newport to Cardiff, Leicester, Sunderland, etc.[559]

Throughout this thesis I aimed to redress the historiographical distortion in our understanding of the Victorian telegraph, a distortion caused by the prominence given to telegrams in past historical discourses. The electric telegraph was not just about telegrams (public telegraphy). It was also about private telegraphy, a more immediate form of telegraphic communication underpinned by private wires. To achieve this aim, I exposed the dichotomy between public and private telegraphy – the duality paradigm. In effect, I deconstructed the Victorian telegraph, taking into account its overlap with postal services and its synergy with telephony, to establish that not one but two strands of land telegraphy existed at this time. This multi-directional aspect of the Victorian telegraph has been overlooked in past histories.

This reappraisal was articulated around the three interconnected questions introduced in Chapter 1. The first asked to what extent the advent of telegrams

[558] Dickens, 'House-Top Telegraphs', 108.

[559] 'Twenty Seventh Report of the Postmaster-General on the Post Office', 1881. 4.

constituted the revolution in communication often portrayed by early and popular historians. For this question, I probed the level of disruption caused by telegrams in relation to letters, and the answer is provided in section one below, entitled '**Telegrams expressing continuity in the history of communication'**. The second question asked to what extent and in what ways private telegraphy was distinct from public telegraphy. It is dealt with in the second section, entitled '**The distinctiveness of private telegraphy'**. Finally, the third question (in what respects telephony can be seen as continuous with and an extension of private telegraphy?) is tackled in section three: '**The transformation of the Post Office into a telephone operator'**.

In this empirical study of private telegraphy, I also touched upon two theoretical frameworks in regard to technological change: the Social Construction of Technology (SCOT) and the domestication theory. I reflect upon these in section four, entitled **'The production and consumption of private telegraphy'**.

Lastly, this research into the history of the Victorian telegraph has identified potential areas for **further research**, which are suggested in section five.

7.1. Telegrams expressing continuity in the history of communication

In dealing with the question of whether the advent of telegrams constituted a revolution in communication, I looked at postal services in Chapter 2 to determine in Chapter 3 whether telegrams were a step change in interpersonal communication. The rationale for this question was to provide a frame of reference for the second question which dealt with the distinctive nature of private telegraphy.

Early and popular historians of the electric telegraph touted that telegrams were a revolution in communication.[560] More recent historians of the Victorian telegraph carefully avoided making such a claim because of its lack of defensibility in the confines of studies focused exclusively on telegraphy. The methodology employed in my thesis, however, was to analyse the development of the electric telegraph in Britain against the backdrop of mainstream postal services, drawing comparisons between letters and telegrams and assessing the level of disruption brought by the latter. This comparative analysis led to the conclusion that there was an interplay between telegrams and letters, and that Victorians perceived telegrams as complementary to or even interchangeable with letters. Save for the laconic style of telegrams, both forms of communication provided a similar service. In other words, telegrams were not as disruptive as might previously have been thought.

As illustrated in the first epigraph, Charles Dickens, a keen observer of Victorian society, believed that telegrams competed with letters. The model adopted by the private telegraph companies for delivering public telegraphy emulated essentially that of the postal services. As indicated in Chapter 3, this model was based on collection points and delivery messengers. The telegraph companies also adopted the stamp as a form of payment for telegrams, as the Post Office had done for letters. Even the concept of the penny post, with pricing irrespective of distance, was adopted by one of the companies (UKTC). If we set aside the concise format of the telegrams, the main

[560] As Albion stated: 'It is scarcely necessary to call attention to the fact that the changes in communication were as "revolutionary" as those in the industrial and other fields.' Albion, 'The "Communication Revolution"', 719. Standage, for his part, introduced the telegraph as '[unleashing] the greatest revolution in communications since the printing press'. Standage, *The Victorian Internet*, VIII.

difference between the two forms of communication was their mode of transmission: conveyance by train for letters and transmission through the medium of electricity for telegrams. Telegrams, in effect, were not fundamentally different in operation from letters, nor were they a significantly faster means of communication for any but the most distant places. Indeed, they offered no advantage of any kind over shorter distances such as intra-urban communication. In London, in particular, by 1840 there were already six mail deliveries per day and this was subsequently increased to an hourly delivery cycle; letters could be posted and delivered to the recipient in less than two hours.

As far as users were concerned, therefore, telegrams did not constitute a discontinuity in the history of communication. There was indeed continuity between these two forms of communication, and for all intents and purposes telegrams were letters. On the basis of this finding, I argue that the rivalry between telegrams and letters was an important factor in the nationalisation of the telegraphs. As noted in Chapter 3, the Post Office Management Act, 1837 provided an exception to the monopoly granted to the Post Office on the conveyance of letters, for those letters sent by a 'messenger on purpose concerning the private affairs of the sender or receiver'.[561] This Act had been passed before the invention of a practical electric telegraph, but the telegraph companies later justified the delivery of telegrams by messenger on this basis, and therefore could not be faulted for encroaching on the monopoly of the Post Office. With the increasing popularity of telegrams as a form of correspondence, however, the distinction between telegrams and letters as far as the Act was concerned was more

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[561] 'An Act for the Management of the Post Office'.

subtle. It is interesting to note that none of the contemporaries who ‘thought it desirable that the telegraphs of this country should be placed in the hands of the State’, from Rowland Hill in 1852 to John Lewis Ricardo in 1858, made reference to a breach of monopoly.[562] All, including Dickens, recognised the rivalry between telegrams and letters though. This absence of reference to a potential breach of monopoly explains perhaps why historians of the Victorian telegraph have overlooked this causal connection to nationalisation. Perry wrote that the growth of government and political ideology were the only factors that precipitated nationalisation. I contend that these factors alone were not sufficient and argue that the nationalisation would not have taken place had the companies adopted a different business model – one which would not have suggested an analogy between telegrams and letters. To this end, I put forward two counterfactual scenarios. In the first scenario, the companies would have provided ‘electric highways’ to convey telegrams on behalf of the Post Office instead of building an ‘electric post office’ that competed with it – in effect, acting as a ‘transport operator’ in the same way that railway companies did. In the second scenario, I described a model that used neither collection points nor a delivery by messengers – a model with no human mediation, and therefore a model drastically different from the one employed by the Post Office at the time. Calls for nationalisation would have been highly unlikely under either scenario because the rivalry between telegrams and letters would not have existed. For all these reasons, I came to the conclusion that this rivalry was an important

[562] During the second reading of the Bill, the Duke of Montrose mentioned that, in 1858, Mr Ricardo (then Chairman of ETC) wrote to Mr Gladstone to explain his reasons for ‘thinking it desirable that the telegraphs of this country should be placed in the hands of the State’. ‘Electric Telegraph Bill - Second Reading’ (HL Deb Vol 193, 24 July 1868).

factor in the nationalisation and that telegrams did not truly constitute a revolution in the history of communication.

7.2. The distinctiveness of private telegraphy

I also argued that public and private telegraphy were two very distinct forms of telegraphic communication, and that the lack of differentiation between public and private telegraphy in the historical literature had prevented a full appreciation of the Victorian telegraph. One strong indication of this distinctiveness was given in the second counterfactual scenario mentioned above, which actually described the private telegraphy model adopted by UPTC. I revealed in Chapter 5 that the appropriation of UPTC had not been initially envisioned by Scudamore. This is perhaps the strongest evidence that private telegraphy differed fundamentally from public telegraphy. Indeed, it was only following a request by the company that the Duke of Montrose, the Postmaster-General at the time, eventually agreed to nationalise the private wires.

Although quicker than the conveyance of letters by mail trains, especially for longer distances, telegrams incurred a significant end-to-end latency between senders and recipients of messages. The main source of this latency was the mediation by operators and messenger boys – in other words, the transcription and delivery services. Unlike public telegraphy, private telegraphy (as initially conceived by Waterlow and Wheatstone) did not need human mediation – it simply required domesticated instruments (the ABC instruments) and the private wires through which the electric currents carried the messages. It was a direct, user-to-user communication system that could be used by any literate person. As I indicated in Chapter 4 and Chapter 5, users of private telegraphy were mostly businesses which rapidly embedded the technology into work practices. From the very beginning, private telegraphy was perceived by Victorians as a communication tool that accelerated the pace of business.

The quasi-instantaneity of private telegraphy set it apart from public telegraphy, and this immediacy in communication empowered a whole range of new applications. Indeed, the private wires were not limited to interpersonal communication. For instance, they were employed by Julius Reuter to deliver his Continental telegrams directly to the newspapers. Press wires were another type of private telegraphy application that greatly benefited the media and news readers in the provinces. Such wires were used during the day to carry telegrams for the public at large – in other words, they were an integral part of the shared network infrastructure. At night, however, the same wires were reconfigured to be dedicated to the newspapers that could afford them: they became private wires. Through these wires, newspapers received the news accumulated during the day, for publication the next morning – a massive amount of data that the newspapers would have been unable to collect using press telegrams. In a similar manner, stock wires delivered, this time during the day, stock information, in addition to carrying transactions between parties. Because they were used during the day, their deployment was limited to provincial exchanges that warranted a high volume of transactions, usually in connection with the London Stock Exchange.

The use of private wires for time-sensitive purposes was another important application of private telegraphy. The regulation of time, in particular, was increasingly popular from the 1860s. As the Post Office took over the management of private wires, the Private Telegraph Department of the Post Office quickly recognised the importance of timekeeping, and a comprehensive set of services was offered to businesses and to those who wished to have the luxury of time currents. All such services were based on the time signals provided by the Royal Observatory at Greenwich. Businesses progressively eliminated the uncertainty of mechanical clocks in offices and factories, adopting instead electric ('sympathetic') clocks that increased the efficiency of their operations. Timekeeping services were delivered to customer premises over private wires and provided either the ten o'clock or the one o'clock currents. These currents transited over the public network, thus interrupting for a moment their operation, before being transmitted to their final destination over the private wires and fed into the sympathetic clocks in offices, factories and even homes.

Private wires were also employed in scientific, industrial and many other applications, such as the measurement of longitudes or the improvement in safety for mining operations. Private telegraphy was undeniably versatile, and it was the benefits it offered in terms of immediacy of communication which set it apart from public telegraphy.

7.3. The transformation of the Post Office into a telephone operator

The question of continuity between telephony and private telegraphy, or telephony as an extension of private telegraphy, has never been addressed hitherto because private telegraphy was overlooked in past studies. Evidence has been provided in this thesis as to the extent to which private telegraphy affected the development of telephony. Private telegraphy was indeed the missing link between telegraphy and telephony. I argued that telephony did not develop in parallel with, or independently of telegraphy – synergies existed between the two modes of communication. Private telegraphy enabled the Post Office to become an active participant in the nascent telephone industry, alongside the private telephone companies. By stating that the Post Office hampered the development of telephony to protect the revenue of telegraphy, Kieve oversimplified the issue by focusing on public telegraphy and ignoring private telegraphy.[563] Charles Perry, for his part, missed an important episode in the history of telephony in Britain, by overlooking technological considerations, and by concentrating instead on the regulatory environment. He reduced the early contribution of the Post Office to telephony to a trunk line agreement in 1892, when trunk lines were nationalised.[564]

The two arguments I put forward in support of a link between private telegraphy and telephony are, first, the reconfiguration of the telegraphic intercommunication systems – the so-called Umschalters – into telephone exchanges, and second, the dual use of private wires. In regard to the Umschalters, I revealed in Chapter 6 how the expertise acquired by the Telegraph Department in the early 1870s to provide intercommunication services between renters of ABC instruments, or between such renters and the local telegraph office, was leveraged by the Post Office to justify to the Treasury its ability to compete with the private telephone companies by providing exchange telephony. The reconfiguration of these early telegraphic switchboards allowed the Post Office to offer an exchange telephony service to its private wire renters, about a year after the private telephone companies had started to offer a similar service to the public. The first of these reconfigured Umschalters was put in

[563] 'The Post Office policy appeared to be a deliberate attempt to stand between the public and the full utilisation of a great scientific invention'. Kieve, *The Electric Telegraph*, 214.

[564] 'The Department's genuine commitment to development [of telephony] may be illustrated by its stand on the issue of intercommunication [that is, trunk arrangements between private telephone companies]. Perry, *The Victorian Post Office*, 167.

service in the Swansea district on 23 March 1881. Many more followed in other towns across the country as indicated by the second epigraph. I also described how renters of ABC instruments in Swansea virtually forced the Post Office to make use of existing private wires for telegraphy as well as for telephony purposes. This arrangement presented a cost benefit for the renters, as they were able to switch conveniently between their ABC and telephone over a single line. However, it also posed a significant electrical interference risk as the wires carrying the strong telegraphic currents were in close proximity to the wires carrying the weaker telephonic signals, and this configuration affected the quality of the telephone service.

As exchange telephony began to overshadow telegraphy, the visibility of telegraphic private wires started to fade. That is not to say that they disappeared altogether: the private telephone companies, like the Post Office, relied on private wires to connect their subscribers, and these private wires were now simply referred to as subscriber lines.

Nonetheless, both the private wires and the Umschalter technology had enabled the Post Office to become a telephone operator, even though the Umschalters were not the optimal telephone exchange solution, and the Post Office employed them for just a few years. In becoming a telephone operator, however, the Postmaster-General faced a conflict of interest: that of being an active participant in the industry he was also regulating.

7.4. The production and consumption of private telegraphy

Unlike public telegraphy which had been from the start a technology in search of a market (or, as George Basalla put it, ‘it was an invention which gave birth to a necessity'), private telegraphy originated from a genuine want.[565] I revealed in Chapter 4 that, in 1857, Sydney Waterlow shaped electric telegraph technology as it was at the time to meet his objective, which was to explore the feasibility of a private telegraphic communication network for the City of London Police. In this prime example of interpretative flexibility, Waterlow gave a new meaning to the electric telegraph by creating an architecture that foretold the age of private telegraphy with its private wires and domesticated instruments. Indeed, private telegraphy soon became a communication tool embraced by hundreds of businesses across the country, and many more after nationalisation. Once these organisations appropriated the technology and embedded it into work practices, they could not withdraw it without negatively impacting the quality of their operations. For instance, news was now fresh and quasi-immediate, and orders were fulfilled without any delay. In other words, once routinized by users, private telegraphy was virtually irreversible. Its perceived value was then communicated back to the market, creating a strong incentive for others to follow.

My use of the term 'interpretative flexibility' above, however, should not suggest a blanket endorsement of SCOT's social constructivist approach, as proposed by Pinch and Bijker in 1984, and later updated by Bijker.[566] I argue that the emphasis this approach put on the social (to the detriment of the technological) creates a form of

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[565] George Basalla, *The Evolution of Technology* (Cambridge, Mass.: Cambridge University Press, 1988), 7. Railway companies initially opposed or resisted the use of the electric telegraph for train safety purpose, and it was not before the early 1850s that telegrams began to be employed widely.

[566] In 1993, Bijker expanded the SCOT framework, introducing in particular the concept of 'technological frames'. Wiebe E Bijker, 'Do Not Despair: There Is Life After Constructivism', *Science, Technology & Human Values* 18, no. 1 (1993): 113–38.

social determinism. Specifically, SCOT misses the ‘intertwining of society and technology’, as Donald Mackenzie and Judy Wajcman put it.[567] The Penny-farthing case study that Pinch and Bijker put forward in their original paper to explore the concept of interpretative flexibility did not explain why this high-wheeled bicycle was originally conceived. They simply explained its relevance to a social group, namely the ‘young men of means and nerve’ who wanted to impress their lady-friends in Hyde Park.[568]

In my thesis, I have put more emphasis on the original meaning attribution and the mutual shaping of technology and social forces. Waterlow only partially (socially) constructed private telegraphy, as the economic viability of the private wires and the fully domesticated instruments had yet to be demonstrated. Said differently, the new meaning attributed by Sydney Waterlow to electric telegraph technology as it was then, was only a partial (social) construction of private telegraphy. However, it motivated Wheatstone to instigate further changes to the technology (that is, a multi-tenant cabling system for the private wires and a domesticated instrument), which led to the completion of its construction.

For private telegraphy, there were thus two distinct phases of development: the first phase was the initial collaborative construction phase, with Sydney Waterlow assigning a new meaning to the electric telegraph and Charles Wheatstone completing its shaping. The second phase was the take-up and feedback process by relevant social

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[567] Donald MacKenzie and Judy Wajcman, eds., *The Social Shaping of Technology*, Second (Buckingham: Open University Press, 1999). This is also referred to as the dualism between technology and the social by Grint and Woolgar, *The Machine at Work*, 21.

[568] Pinch and Bijker, ‘The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other’, 415.

groups (newspapers, manufacturers, police departments, etc.) – a process also described by Lie and Sorensen as 'consumption as production'.[569] The effect of this secondary production was a positive feedback loop which accelerated the take-up process.

The second phase was thus also about reciprocal changes: the mutual shaping of technology and social forces occurred during the appropriation of private telegraphy by users, when they began to incorporate the technology into their everyday life. Private telegraphy necessitated the domestication of both the private wires and the ABC instruments. Although it was the first time that electricity was brought into homes and offices, long before the electrification of the household for electric lighting, it was the domestication of the ABC instruments that mattered most for private telegraphy. As noted in Chapter 4, Wheatstone filed in 1858 a patent describing the first model of this instrument. The collaborative construction phase discussed above was the commodification process.[570] The value inscribed in the technology in this case was user-friendliness, that is to say, the ABC instrument's ability to be operated by any literate person, from any office, factory or home environment reachable by private wires. Relevant social groups, or users in various business communities, then appropriated the technology, and communicated back to society their reaction or perception of the instrument (and the concept of private telegraphy in general) as part of the conversion stage. The improvements to the ABC instrument specified by Wheatstone in his 1860

[569] Lie and Sorensen, *Making Technology Our Own - Domesticating Technology into Everyday Life*, 8.

[570] As seen in Chapter 1, the phases of the domestication process are commodification, appropriation and conversion.

patent were likely the result of such feedback. As Roger Silverstone and Eric Hirsch pointed out, users are not passive recipients of a technology, they shape it to suit their practical needs and such was the case with private telegraphy.[571]

7.5. Further research

During this research into private telegraphy I have identified several areas which could be worthy of further study. I present below four suggestions: a study of multiplex technology, an international study of private telegraphy, research into early machine communication, and finally, a more detailed study of stock wires.

The vast majority of private wires were eventually absorbed by telephony and became better known as subscriber lines. Telegraphic wires, both public and private, however, still remained in existence well into the twentieth century. For instance, as mentioned in Chapter 4, private wires were used with ABC instruments to provide communication between Oban and the isolated post office on the remote island of Eriskay as late as 1935, and probably even later. Well before morphing into the leased lines of the twentieth century, however, telegraphic wires evolved rapidly in the 1870s. The **multiplex technology** (duplex and quadruplex) was based on the design of acoustic or harmonic telegraphs. It allowed the simultaneous transmission of multiple messages over a single wire, thus increasing the capacity and efficiency of wires without having to

[571] Silverstone and Hirsch, *Consuming Technologies - Media and Information in Domestic Spaces*, 25.

make heavy infrastructure-related investment.[572] The technology may have been inspired by the German physicist Hermann von Helmholtz or possibly by Dr Wilhelm Gintl in Vienna, but Alexander Bell, Elisha Gray and Thomas Edison worked on its application to telegraphy.[573] The Post Office acquired an exclusive licence from Edison on 2 February 1875 for 'improvements in duplex and multiplex telegraphs' for a term of 14 years.[574] By 1884, there were 18 permanent circuits worked with quadruplex technology in Britain, plus temporary on-demand circuits used for the race meetings in Ascot, Derby, etc. The press wires are likely to have benefited from this technology.[575] Such a study could span the late nineteenth century and the first half of the next century, perhaps exploring in the process the descendants of private telegraphy: the telex network and the teleprinters.

I have also provided in Chapter 4 a limited international perspective on private telegraphy, which comprised a comparison between Britain, America and France. We saw, for instance, that Britain was leading the US in terms of commercial implementation of private wires (the Gold and Stock Telegraph Company did not begin offering private wires commercially until 1869). Meanwhile, in France, the concept of

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[572] In a quadruplex system, four operators sat at either end of the wire, two senders and two receivers.

[573] Allen and Hecht, *Technologies of Power*, 33. Bray, *Innovation and the Communication Revolution*, 22.

[574] 'Quadruplex Telegraphs (in Folder: Royalty for the Use of Quadruplex Telegraph Apparatus 1874-1885)', Post 30/394A, BT Archives. See also references to duplex telegraphy in the Journal of the Society of Telegraph Engineers, 1876, vol 5, issue 15; and quadruplex in the *Liverpool Daily Courier* dated 6 October 1977.

[575] 'Twenty Sixth Report of the Postmaster-General on the Post Office', 1880. 14. Reference is made here to issues with the Wheatstone Automatic instrument and the quadruplex apparatus. It is assumed that this also applies to press wires where the Wheatstone Automatic was employed.

private telegraphy was really about private communications over a shared public infrastructure, not about private wires. A more detailed **international study of private telegraphy** that would include countries such as Germany, Belgium and Switzerland (all referenced by many witnesses called upon by various select committees in the days leading to nationalisation), amongst other countries, would provide a more global perspective.

The Internet of Things (IoT) is the focus of much attention nowadays, not the least because 'the number of connected devices could be anywhere from 20 billion to 100 billion by 2020'.[576] The current definition of IoT encompasses machine-to-machine and machine-to-human communication, and includes a wide variety of applications from sensor networks for agriculture or flood control, to medical or wellbeing applications. Few people involved in these applications today realise that their origin can be traced back to the private wires of Victorian Britain. **Machine communication** applications included the 'sympathetic' clocks as well as the 'chronopher' that sent the time currents, but many more connected devices were enabled by private wires in this period. Weather balloons transmitted temperature and pressure information along a thin wire extending to the ground. The Wheatstone's 'meteorograph', for instance, used a wet-and-dry-bulb thermometer and a mercury barometer, transmitting information every half-hour to be printed at a receiving station.[577] Another example is the 'telemaregraph', an instrument

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[576] Mark Walport, 'The Internet of Things: Making the Most of the Second Digital Revolution. A Report by the UK Government Chief Scientific Adviser' (London: Government Office for Science, December 2014), 14.

[577] W. E. Knowles Middleton, *The History of the Barometer* (Baltimore: The Johns Hopkins University Press, 1964), 329.

connected by telegraphic wire to provide the height of the tide every five to ten minutes.[578] Such research into machine communication in the nineteenth century would also expand on the versatility of private wires.

The **stock wires** have been briefly mentioned in Chapter 5 as an application of private telegraphy, following a more thorough analysis of the press wires. Yet their impact on the financial markets had been as significant as the press wires had been for the media. The economic historian Ranald Richie wrote that ‘the revolution in communications that took place in the second half of the nineteenth century with the introduction of the telegraph and the telephone was to transform the securities market, and to alter fundamentally the role performed by the London Stock Exchange’.[579] Four decades earlier, William Thomas had written about provincial stock exchanges, stating that ‘it was the telegraph system which brought the biggest changes in that it greatly facilitated inter-market business with rapid transmission of prices and orders’.[580] Indeed, the telegraphs, and the stock wires in particular, made possible the dematerialisation of trading and the creation of an integrated securities market, and their history, from a social and technological perspective, remains to be told.

578 Anon, ‘Telemaregraphs’, *The Electrician: A Weekly Journal of Theoretical and Applied Electricity and Chemical Physics* XVII (14 November 1886).

579 Michie, *The London and New York Stock Exchanges 1850-1914*, 8.

580 Thomas, *The Provincial Stock Exchanges*, 102.

7.6. Concluding remarks

As a field of study, the Victorian telegraph has attracted much scholarly attention, and the body of works on this topic from social, economic and technology historians is substantial. Yet, as my thesis reveals, there remains much to explore.

The originality of my thesis, my main contribution to knowledge, is the revelation of the existence of a second and parallel path of development for the Victorian telegraph in the shape of private telegraphy. Britain differed from America and France, and probably from other countries as well in that regard. This British distinctiveness had been ignored by historians, yet its significance in terms of societal impact cannot be understated. Moreover, behind this new perspective on the Victorian telegraph was a study in immediacy in communication. Telegrams were not as disruptive to Victorians as previously thought because letters were at the time a very efficient and convenient form of communication, as well as being as fast on shorter distances. The societal disruption came from the private wires. As more and more businesses embraced private telegraphy, the Victorians' perception of temporal and spatial immediacy in communication was radically altered. If there was a revolution in communication, it came from private telegraphy.

Two figures amongst the dramatis personae in the history of private telegraphy stand apart for having contributed most to this revolutionary concept: Sydney Waterlow, the politician and businessman who gave a new meaning to the electric telegraph; and Charles Wheatstone, the visionary and the man of science behind the technology. In making private telegraphy a reality, they opened a path for future private communication networks.

Appendices

Appendix 1. Sir Charles Wheatstone

Born in Gloucester, Charles Wheatstone (1802-1875) was the son of William Wheatstone, a shoemaker.[581] His family moved to London in 1806, and during his school years in the metropolis he learnt French, Latin and Greek, as well as mathematics and physics. According to Bower, he became acquainted with electricity while reading an account, in French, of Volta's experiments.[582] He also became involved in the musical instrument manufacturing business of his uncle, Charles Wheatstone, in the Strand.[583] His first creation as a musical instrument maker was a novel instrument called the 'Enchanted Lyre'. He demonstrated its 'astonishing effect' to the public in his father's shop at '118, Pall-Mall, opposite the Colonnade' for an admission fee of three shillings per person. A year later, almost to the day, the press was still reporting the 'progress of Mr Wheatstone's invention for augmenting the intensity and richness of musical sound'.[584]

With his younger brother William, he took over the business of his uncle upon his death in 1823; and in that same year, he published his first scientific paper in which his passion for matters of communication is already perceptible. Its section on 'Rectilinear Transmission of Sound' observes the transmission of sound through linear conductors

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[581] Cooper Thompson, ed., *Men of the Time: A Dictionary of Contemporaries Containing Bibliographical Notices of Eminent Characters of Both Sexes*, Ninth Edition (London: George Routledge and Sons, 1875), 999–1000.

[582] Ibid. Bowers, *Sir Charles Wheatstone FRS 1802-1875*.

[583] 'The Enchanted Lyre', *Morning Chronicle*, 11 July 1821, 1.

[584] 'The Progress of Mr Wheatstone's Invention', *Morning Post*, 5 July 1822, 1.

to an appropriate receiver, which in this case was a lyre (the 'Enchanted Lyre') suspended on a brass wire connected to the sound board of a stringed instrument such as a harp or a piano:[585]

> Pursuing my investigations on this subject, I have discovered means of transmitting, through rods of much greater lengths and of very inconsiderable thicknesses, the sound of all musical instruments dependent on the vibrations of wind instruments.[586]

From research into the transmission of sounds, Wheatstone went on to create a device known as the Kaleidophone, which transformed vibrations into the 'most diversified and elegant curvilinear forms'.[587] The vibrations were created by means of solid rods of various shapes and lengths, which were struck by a padded hammer or similar object. By 1829, Wheatstone had moved to Conduit Street where, with his brother, he continued the family business of selling musical instruments and publishing music. It was in those premises that Wheatstone invented the successful concertina instrument which sold in the thousands. The sale of musical instruments, alongside the promotion of other scientific toys and inventions such as the kaleidophone reveals a strong business acumen, a side of Wheatstone perhaps not so well known.

However, scientific research soon became his main interest. In 1833, the year before his appointment to King's College, he began an investigation into the velocity of electricity that was partly based on his work on the Kaleidophone. With the use of a mirror, he had established that the rapid motion of a light, such as one generated by an

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585 Charles Wheatstone, 'New Experiments on Sound', *Annals of Philosophy* vi (August 1823): 81–90.

586 Ibid., 86.

587 Charles Wheatstone, 'Description of the Kaleidophone, or Phonic Kaleidoscope; a New Philosophical Toy, for the Illustration of Several Interesting and Amusing Acoustical and Optical Phenomena', *Quarterly Journal of Science, Literature, and Arts* i (1827): 344.

electrical spark, could appear as a continuous line due to the persistence of vision. It occurred to him that if the motion that produced this line could be combined with another motion, by rotating the mirror in a given direction and at a constant speed, it would be possible to determine the velocity of the former.[588] To this end, Wheatstone observed the elongation and angular deflection of the lines, representing the difference in time between the occurrences of sparks generated at the opposite extremities of half a mile of insulated copper wire, as the electric current generated by a Leyden jar connected at one extremity travelled down the line. With the mirror revolving 800 times per second, Wheatstone determined the velocity of electricity at 288,000 miles per second. This was, of course, a crude calculation, but it was the first time that the velocity of electricity had been tentatively established, and this experiment propelled Wheatstone into the scientific limelight.[589]

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[588] Charles Wheatstone, 'An Account of Some Experiments to Measure the Velocity of Electricity and the Duration of Electric Light', *Philosophical Transactions of the Royal Society of London* 124 (1 January 1834): 583.

[589] In his paper, Wheatstone mentioned the unsuccessful attempt by Dr Watson at Shooter's Hill in 1747 to measure the interval of time between two electrical discharges in a four mile circuit. Wheatstone continued working on this experiment for many years. According to Bowers, Wheatstone had also been present at some of Sir Francis Ronalds' experiments with an electric telegraph at Hammersmith in 1817, whose purpose was to observe (inconclusively) the time that elapsed between the firing of an electrical machine at one end of a wire, and the firing of a cannon at its other end. Wheatstone eventually determined, circa 1840, that the velocity of electricity was between 150,000 to 180,000 miles per second – a little less than the speed of light (See Bowers, *Sir Charles Wheatstone FRS 1802-1875*, 58, 66.). It is also significant that during a lecture in June 1836, Wheatstone repeated the above experiment using four miles of insulated copper wire, but this time using a voltaic battery at one end of the line to deflect a galvanometer needle at the other end. During the lecture, he also provided a sketch of an electric telegraph that was based on the same principle and used 'a few finger stops' to transmit signals. Anon, 'New Experiments in Electro-Magnetism', *Magazine of Popular Science and Journal of the Useful Arts* 3 (1837): 110.

Wheatstone's wide range of research led him to several other inventions, like the stereoscope which dealt with the phenomenon of binocular vision and produced a three-dimensional representation of an object from two different flat perspectives of that object.[590]

Electricity, however, remained his field of predilection and this is where he invested most of his research time. The experiment regarding the velocity of electricity had made him a prominent figure amongst the men of science of the time, and his work on electrical measurements brought him further recognition. This work, perhaps better recognised for one of its applications – the Wheatstone bridge – had a lasting impact on telegraphy and indeed on the teaching of electrical engineering right up to the twenty first century.

As an introduction to his paper presented to the Royal Society on 15 June 1843, Wheatstone stated that his intention had been to 'ascertain the most advantageous conditions for the production of electric effects through circuits of great extent, in order to determine the practicality of communicating signals by means of electric currents to more considerable distances that had hitherto been attempted'.[591] There was nothing new in this paper from a theoretical point of view, as Wheatstone was 'merely' applying Ohm's theory, but it was his application of the theory in the section titled 'The Differential Resistance Measurer' that caught the attention of the scientific community.

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[590] Charles Wheatstone, 'Contributions to the Physiology of Vision. Part the First. On Some Remarkable, and Hitherto Unobserved, Phenomena of Binocular Vision', *Philosophical Transactions of the Royal Society of London* 128 (1838): 371–94.

[591] Charles Wheatstone, 'An Account of Several New Instruments and Processes for Determining the Constants of a Voltaic Circuit', *Philosophical Transactions of the Royal Society of London* 133 (1843): 303.

It provided for a practical method for comparing and measuring electrical resistances without having to resort to a calibration procedure – a procedure he was able to avoid by employing a rheostat that was adjusted until the galvanometer gave no indication of a current flow. With the proper circuit, Wheatstone's bridge was thus able to detect small changes in resistance, and this device had significant use in future telegraphy, and other fields.[592]

Two footnotes in the paper suggest that Wheatstone had been working on the subject for many years, and possibly since the mid-1830s. The first referred to a discussion with Professor Jacobi of St Petersburg in August 1840 when both men exchanged views on measuring instruments they had both independently constructed but which were working on the same principle. During the course of this private discussion, and later in a public address during a meeting of the British Association in Glasgow, Jacobi acknowledged Wheatstone's superior design. The second footnote relates to the credit given by Wheatstone to Samuel Hunter Christie, F.R.S., for having been the first to come up with the concept of a differential arrangement, and with the idea of accurately measuring resistances in this way, although Christie did not go as far

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[592] Detecting broken or damaged wires had been a major challenge since the early days of the telegraph. It was reported in 1840 that the difficulty in locating such a fault had been resolved 'by means of a small carriage moved along the line of the telegraph. The place where the defect lies is indicated by a magnetic needle which changes its position the instant it arrives at the part where the connection is broken'. 'Professor Wheatstone', *The Times*, 16 October 1840, 5. It should be noted that Part C of Cooke's 1838 patent (second specification) also described a 'suitable portable apparatus' for the purpose of 'proving the metallic continuity of several telegraphic wires'. Cooke, 1838 Specification, 43. Reference to a detector is also made in 'Cooke's Improved Electric Telegraph', *Morning Post*, 25 May 1843, 2.

as constructing a practical instrument as Wheatstone did.[593] Wheatstone is likely to have read Christie's paper, and his credit to him suggests integrity on his part – an ethical conduct which challenges those who accused him later of falling 'little short of intellectual dishonesty'.[594] Crucially too, the design of this instrument demonstrates Wheatstone's practicality – an intellectual approach that would be confirmed during the course of his involvement with telegraphy.

This insight into Wheatstone's scientific achievements has shown his involvement in subjects as varied as acoustics, optics, and electricity. His broad interest in scientific matters was coupled with a commitment to the family music business, and it was the combination of his inquisitive mind, pragmatism and business acumen that seems to have governed his work on telegraphy.

[593] Christie's paper, titled 'Experimental determination of the Laws of Magneto-electric Induction' was published in 1833, but did not attract attention until the publication of Wheatstone's paper in 1843.

[594] Marland, *Early Electrical Communication*, 7.

Appendix 2. UPTC Customer List (partial)

Customer	UPTC office	District	Sector	Source[595]
A & A Galbraith	Glasgow	Glasgow	Unknown	GH 241062
A. Claudet	Unknown	Unknown	Unknown	TGJ/1/4
Alliance Fire Office	London	London	Financial	Post 30/226C
Allison Ralph & Sons	London	London	Unknown	TGJ/1/4
B. Hyans & Sons	Unknown	Unknown	Unknown	TGJ/1/4
Balloch, Lade & Co	Glasgow	Glasgow	Miscellaneous	GH 241062
Bass & Company	London	London	Unknown	Post 30/226C
Bell Brothers	Unknown	Unknown	Unknown	TGJ/2/1/2
Blythe Brothers	London	London	Unknown	Post 30/226C
Board of Admiralty	London	London	Public	TGJ/2/1/2
Board of Trade	London	London	Public	TGJ/1/4
Bonelli Telegraph Co	London	London	Telegraph	TGJ/2/2/1
Cabinet Ministers	London	London	Public	TGJ/1/4
Chartered Gas Co	London	London	Utilities	Post 30/226C
Chas. Tennant & Co	Glasgow	Glasgow	Unknown	GH 241062
City & Suburban Gas Company	Glasgow	Glasgow	Utilities	GH 241062
City of London Police	London	London	Public	Post 30/226C
Clay Lane Iron Co	Unknown	Unknown	Industry	TGJ/2/1/2
Commercial Road Trust	London	London	Transport	Post 30/226C
Commissioners of Inland Revenue	London	London	Public	Post 30/226C
Commissioners of Woods & Forests	London	London	Public	Post 30/226C
Cox & Co	London	London	Unknown	TGJ/1/4

595 GH, DN and LR stand for *Glasgow Herald*, *Daily News*, and *The London Review* respectively (followed by date in *ddmmyy* format). TGJ and POST (followed by reference number) are documents located in BT Archives.

Craven	Unknown	Unknown	Unknown	TGJ/1/4
Daily Telegraph	London	London	Media & Publishing	TGJ/1/4
Dakin & Company	London	London	Unknown	Post 30/226C
David Hutcheson & Co	Glasgow	Glasgow	Shipping	GH 241062
Dickens Company	Unknown	unknown	Unknown	TGJ/2/2/1
Dixon & Harris	Unknown	unknown	Unknown	TGJ/1/4
Dr Edmunds	Unknown	Unknown	Unknown	TGJ/1/4
Dr Mackenzie	Unknown	unknown	Unknown	TGJ/1/4
East & West India Docks	London	London	Shipping	Post 30/226C
Edinburgh & Glasgow Railway Co	Glasgow	Glasgow	Railway	GH 241062
Electric Telegraph Co	London	London	Telegraph	Post 30/226C
Elkington & Co	London	Birmingham	Industry	TGJ/2/2/1
Eyre & Spottiswoode Co	London	London	Media & Publishing	TGJ/1/4
Fairbairn & Co	Unknown	Unknown	Unknown	TGJ/2/2/1
Frost Bros & Co	London	London	Unknown	TGJ/1/4
G & J Burns	Glasgow	Glasgow	Unknown	GH 241062
Geo. Miller & Co	Glasgow	Glasgow	Unknown	GH 241062
Glasgow Iron Co	Glasgow	Glasgow	Industry	GH 241062
Glasgow Police	Glasgow	Glasgow	Public	TGJ/1/1
Glass, Elliot & Co	London	London	Industry	LR 160361
G. Gouldsmith	London	London	Unknown	TGJ/1/4
Great Northern Railway Co	London	London	Railway	Post 30/226C
Great Western Railway Co	London	London	Transport	POST 30/226C
Greenock Foundry Co	Glasgow	Glasgow	Industry	GH 241062
Haigh Colliery	Manchester	Wakefield	Mining	TGJ/1/4
Handysides & Henderson	Glasgow	Glasgow	Shipping	GH 241062
Her Majesty Customs	London	London	Public	Post 30/226C
Duke of Northumberland	London	London	Unknown	Post 30/226C
Imperial Gas Co	London	London	Utilities	Post 30/226C
J & A Allen	Glasgow	Glasgow	Unknown	GH 241062

J. Graven & Co	Unknown	Unknown	Unknown	TGJ/2/2/1
J. Holden	Manchester	Bradford	Unknown	TGJ/2/2/1
J. Kittle	Unknown	Unknown	Unknown	TGJ/1/4
J. Shaw	Unknown	Unknown	Unknown	TGJ/1/4
J. W. Benson	Unknown	Unknown	Unknown	TGJ/1/4
J.W. Duncan	Unknown	Unknown	Unknown	TGJ/1/4
John Berrie	Unknown	Unknown	Unknown	TGJ/1/4
Julius Reuter	London	London	Media & Publishing	Post 30/226C
Kilner Brothers	Manchester	Wakefield	Industry	TGJ/1/4
Kitson & Co	Unknown	Unknown	Unknown	TGJ/2/2/1
Lancefield Forge Co	Glasgow	Glasgow	Industry	GH 241062
Lawson & Sons	Unknown	Unknown	Unknown	TGJ/2/1/2
Leeds Police	Manchester	Leeds	Public	TGJ/1/4
Lister & Mirfield Co	Manchester	Bradford	Unknown	TGJ/1/4
London & Northwestern Railway Co	London	London	Transport	Post 30/226C
London & Provincial Telegraph Co	London	London	Telegraph	TGJ/1/4
London Docks Company	London	London	Shipping	TGJ/1/4
London Hospital	London	London	Health	TGJ/1/4
London Westminster Bank	London	London	Financial	Post 30/226C
Lord Fitzgerald	London	London	Unknown	TGJ/1/4
Lord Kinnaird	Glasgow	Dundee	Unknown	LR 160361
Manchester Carriage Co	Manchester	Manchester	Transport	TGJ/1/4
Marylebone Vestry	London	London	Public	TGJ/2/1/2
Mersey Dock and Harbour Board	Manchester	Liverpool	Shipping	TGJ/1/4
Messrs Dalglish	Glasgow	Glasgow	Unknown	GH 241062
Messrs De La Rue	London	London	Media & Publishing	Post 30/226C
Messrs Henry Monteith & Co	Glasgow	Glasgow	Industry	GH 241062
Messrs R. Napier & Sons	Glasgow	Glasgow	Shipping	GH 241062

Metropolitan Police	London	London	Public	TGJ/1/4
Middlesex Water Works	London	London	Utilities	TGJ/1/4
Mitchell & Whitlaw	Glasgow	Glasgow	Unknown	GH 241062
Monkbridge Iron Co	Manchester	Leeds	Industry	TGJ/1/4
Morning Chronicle	London	London	Media & Publishing	Post 30/226C
Muir, Brown & Co	Glasgow	Glasgow	Industry	GH 241062
Murdoch & Doddrell	Glasgow	Glasgow	Miscellaneous	GH 241062
National Bank	London	London	Financial	TGJ/2/2/1
Newcastle Daily Chronicle	Newcastle	Newcastle	Media & Publishing	TGJ/2/2/1
Newcastle Water Co	Newcastle	Newcastle	Utilities	TGJ/1/4
Nield & Son	Unknown	Unknown	Unknown	TGJ/2/2/1
Northshore Flour Co	Manchester	Liverpool	Industry	TGJ/2/2/1
Office of Works	London	London	Public	Post 30/226C
Oldham Gas & Water Works	Manchester	Oldham	Utilities	TGJ/1/4
Oldham Police	Manchester	Oldham	Public	TGJ/1/4
P & W M'Lellan	Glasgow	Glasgow	Unknown	GH 241062
Pall Mall Gazette	London	London	Media & Publishing	TGJ/1/4
Parkhead & Vulcan Foundries	Glasgow	Glasgow	Industry	GH 241062
Peel & Co	Unknown	Unknown	Unknown	TGJ/2/2/1
Perkins & Son	London	London	Unknown	TGJ/2/2/1
Pickford & Co	London	London	Transport	TGJ/2/2/1
Platt Brothers	Manchester	Oldham	Industry	DN 270960
Polytechnic Institution	London	London	Miscellaneous	Post 30/226C
Priestman & Co	Unknown	Unknown	Unknown	TGJ/2/2/1
R. Laidlow & Sons	Glasgow	Glasgow	Industry	GH 241062
R. Stapleton	Unknown	Unknown	Unknown	TGJ/1/4
Rawcliffe	Unknown	Unknown	Unknown	TGJ/2/1/2
Ravenhill & Co	London	London	Unknown	TGJ/1/4
Reid Brothers	London	London	Industry	Post 30/226C
Salford Gas Co	Manchester	Manchester	Utilities	TGJ/2/2/1
Seaward Brothers	Unknown	Unknown	Unknown	TGJ/1/4

Silver & Co	London	London	Industry	TGJ/1/4
Smith Beck & Co	London	London	Unknown	TGJ/1/4
South Eastern Railway Co	London	London	Railway	TGJ/1/1
St George's Assurance Co	London	London	Financial	Post 30/226C
St Katherine Dock Company	London	London	Shipping	TGJ/1/1
St Pancras Iron Works Co	London	London	Industry	TGJ/1/4
Straker & Love	Newcastle	Newcastle	Mining	TGJ/2/1/2
Strang & Hamilton	Glasgow	Glasgow	Unknown	GH 241062
Surrey Commercial Dock Company	London	London	Shipping	TGJ/1/4
Swan Coates & Co	Newcastle	Middlesbrough	Mining	TGJ/2/1/2
Todd Bros	Unknown	Unknown	Unknown	TGJ/2/2/1
W & H Forster	Newcastle	Newcastle	Media & Publishing	TGJ/2/1/2
W & J Blackie & Co	Glasgow	Glasgow	Unknown	GH 241062
W & J Fleming & Co	Glasgow	Glasgow	Unknown	GH 241062
W. Clegg	London	London	Unknown	Post 30/226C
W.H. Smith & Son	London	London	Media & Publishing	Post 30/226C
W.W. Browning	London	London	Unknown	Post 30/226C
Walter Scott	Unknown	Unknown	Unknown	TGJ/2/2/1
War Office	London	London	Public	TGJ/1/4
Waterlow & Sons	London	London	Media & Publishing	Post 30/226C
Westminster Hospital	London	London	Health	TGJ/1/1
Westminster Palace Hotel	London	London	Miscellaneous	Post 30/226C
Wheatley Kirk & Co	Manchester	Manchester	Unknown	TGJ/1/1
Whitham Manufacturers	Manchester	Sheffield	Industry	TGJ/2/2/1
Whittle Dean Water Work Company	Newcastle	Newcastle	Utilities	TGJ/2/2/1
Wigan Coal & Iron Co	Manchester	Wigan	Mining	TGJ/1/4
Wm. Holmes Bros	Glasgow	Glasgow	Unknown	GH 241062
Wm. Miller & Sons	Glasgow	Glasgow	Unknown	GH 241062
Wm. Sloan & Co	Glasgow	Glasgow	Unknown	GH 241062

Wylie & Lochhead	Glasgow	Glasgow	Miscellaneous	GH 241062
Yorkshire Engine Company	Manchester	Sheffield	Industry	TGJ/2/2/1
Zoological Society of London	London	London	Public	Post 30/226C

A total of 143 individuals and organisations, segmented as follows:

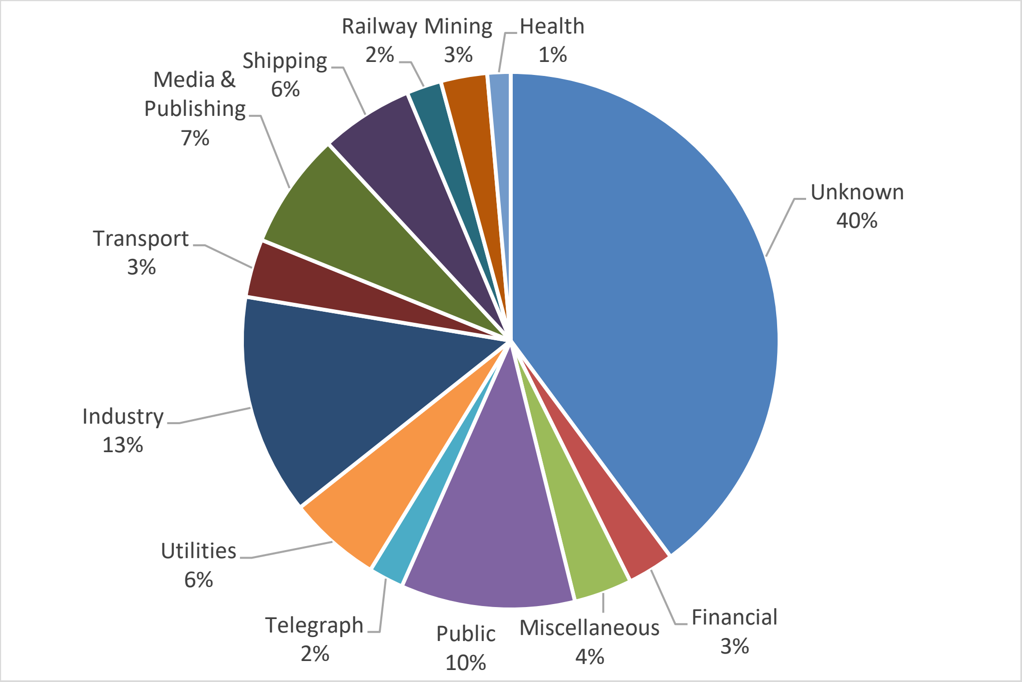

Figure A 2.1. Typology of UPTC Customers

Appendix 3. The Post Office telegraphic intercommunication systems

List of towns having a private wire intercommunication system, with date of commencement (as of December 1880).[596]

Stockton-on-Tees	3 October 1877
Middlesbrough-on-Tees	1 February 1878
Hull	26 February 1878
Newcastle-on-Tyne	29 March 1878
Swansea	7 October 1878
Paisley	21 January 1880
Darlington	26 February 1880
Glasgow	1 April 1880
West Hartlepool	20 April 1880
Sunderland	18 June 1880
Bradford	1 July 1880
Leeds	1 July 1880
Bristol	13 July 1880
Sheffield	26 October 1880
Nottingham	1 November
Leicester	3 November
Barnsley	19 November

[596] 'Postmaster-General to the Treasury: Question of the Establishment of Telephone Exchanges by the Department'. See also: 'Twenty Sixth Report of the Postmaster-General on the Post Office', 1880. 15.

Appendix 4. From needles to dials

In this appendix, I provide a history of the ABC instrument, which was at the heart of private telegraphy. Its history can be traced back to the first joint patent between Cooke and Wheatstone in 1837. This patent is associated with the only needle instrument in the series, with its conspicuous hatchment dial and the 'permutating key-board'. Wheatstone's vision of a domesticated telegraph can already be perceived in this early model with its simplification of the user interface for direct reading. The second and most critical stage in the evolution of private telegraphy occurred in 1840 with the introduction of a step-by-step instrument. The device's user interface was vastly superior to that of the 1837 model in terms of practicality and immediacy of operation. This early version of the step-by-step instrument also played a significant part in the dispute between Cooke and Wheatstone as it clearly brought into evidence the diverging strategies between the two men: a simpler instrument that relied on skilled operators for the former, versus a more complex instrument with an ergonomic user interface fit for domestic use for the latter. Following technological improvements in 1845, Wheatstone filed two major patents in 1858 and 1860, and these two patents represented the third and last stage of the evolution. This was a defining stage in the development of private telegraphy as it introduced a commercially viable ABC instrument, together with a cabling system specifically designed for private wires in an urban environment.

Needles and keyboard

Just three months after their first meeting on 27 February 1837, Cooke and Wheatstone filed their first joint patent for a telegraph instrument. Granted on 12 June 1837, the patent was enrolled in Chancery on 12 December of that same year.[597] Cooke and Wheatstone's first specification, as this patent is also referred to, describes improvements that made this instrument practical, presumably in reference to Cooke's earlier mechanical telegraph that was never operational. The originality of the design was sanctioned by a patent that granted Cooke and Wheatstone exclusivity for a period of fourteen years. The first three improvements described in this specification concern the apparatus known as Wheatstone's Hatchment Dial. The dial was a diamond-shaped vertical board (see Figure A 4.1. below). In its centre and on a horizontal line were five magnetic needles positioned at equal distance from one another – with the needles pointing up at rest, or left or right when deflected by the action of an electrical current. The dial was marked with 20 carefully positioned letters, the letters C, J, Q, U, X and Z being omitted to save the expense of a sixth needle and the associated wire.[598] Letters were indicated by the simultaneous deflections of two needles in contrary directions. Wheatstone's innovations consisted of the vertical mounting of astatic and weighted magnetic needles, the dial alphabetic arrangement, and the permutating keyboard operated by ten brass 'buttons or finger keys' to connect the desired polarity of the

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[597] William Fothergill Cooke and Charles Wheatstone, A.D. 1837, No. 7390 [Improvements in giving signals and sounding alarums in distant places by means of electric currents transmitted through metallic circuits], 7390 (England & Wales, issued 12 June 1837).

[598] Fourteen years earlier, Ronalds' electrical telegraph had used the same twenty letter combination. Ronalds, *Descriptions of an Electrical Telegraph*, 7.

voltaic battery to the magnetic needles.[599] The specification described two models of the instrument: the first employed five wires and ten keys, thus only communicating letters. By adding a sixth wire and its associated pair of keys, however, the instrument was also able to operate a needle at a time, thus allowing numerals to be indicated by the deflection of only one needle, in addition to the dual deflection employed for letters.[600] The alarm was a device based on a conventional bell and a weighted spring clockwork mechanism, activated by an electrical signal from a key sometimes attached to a drawing cord.[601]

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[599] No claim was made for the astatic operation as the use of two reversed needles fixed on the same axis to nullify the effect of earth magnetism had been discovered by André-Marie Ampère in 1820.

[600] Deflecting two needles to indicate a character on both the local and remote dial required the simultaneous depression of two separate keys. Unlike the other five, the sixth wire was not connected to any needle as it was simply an electrical return, but the depression of two keys was still required: the first one for the selected needle, the other to complete the circuit.

[601] In normal transmission mode, the hammer was prevented from striking the bell by a spring-loaded detent (only released by an electromagnet activated by a specific signal from the remote station). For very long lines, one option was to equip the distant alarm with a separate voltaic battery (instead of supplying it with the electrical power of the transmitting instrument) and activating it by the electrolysis of water in a vessel that raised a small column of mercury into an inverted syphon tube to create an electrical circuit with the local battery. Cooke and Wheatstone, 1837 Specification, 42.

Figure A 4.1. Wheatstone's Hatchment Dial, 1837 specification. It was organized in a diamond shape and marked with 20 letters, the letters C, J, Q, U and Z being omitted to save the expense of a sixth needle and associated wire. Letters were indicated by the deflections of two needles in contrary directions, numerals were indicated by the deflection of only one needle. At rest, the needles were in a neutral (vertical) position. Photographed at Blythe House in September 2013 and reproduced with the kind permission of the Science Museum London.

This easy to use instrument (any literate person could, after a short practice, operate the device proficiently) was successfully tested during the London and Birmingham Railway experiment, as Camden Station resident engineer Charles Fox acknowledged in September 1837.[602] However, the cost of constructing and laying five, let alone six wires, was both a financial and engineering burden. For the next project, which took place at the Great Western Railway Company, Cooke eventually designed a two-needle apparatus that used only three wires, the third being used as a common

[602] Wheatstone, *A Reply to Mr Cooke's Pamphlet 'The Electric Telegraph, Was It Invented by Professor Wheatstone?'*, 11.

electrical return. However, this instrument used coded sequences of needle deflection to communicate, thus losing direct read capability.

Step-by-step

Wheatstone was, however, determined to preserve the benefit of direct read. To this end, he designed a new instrument based on Sir Francis Ronalds' electrical telegraph – an earlier concept that employed a circular brass plate inscribed with numbers, letters and 'preparatory signs', whose motion was controlled with a Canton's pith ball electrometer.[603] Wheatstone replaced the Leyden jar with a voltaic battery, and substituted an electromagnet for an electrometer. The instrument was designed to operate on two wires and was built around three elements: a receiver (or indicator), a transmitter (or communicator) and an alarm. Clockwork mechanisms were used throughout. The receiver was a step-by-step indicator pointing directly at a symbol on a circular dial and moving one step at a time, in one direction, with each electrical impulse received from the remote transmitter. The dial described in the 1840 specification was divided into twenty-four sectors identified by letters, numbers and special characters.[604] An alternative was to rotate the circular dial to present the symbol in a small aperture on the front of the instrument (see Figure A 4.1.).[605] Electrical impulses acted on an electromagnet controlling a ratchet movement that released the wound clockwork, which in turn rotated the hand or the dial in concert with the

[603] Ronalds, *Descriptions of an Electrical Telegraph*, 6–7.

[604] Charles Wheatstone and William Fothergill Cooke, A.D. 1840, No. 8345 [Improvements in giving signals and sounding alarums in distant places by means of electric currents transmitted through metallic circuits], 8345 (England & Wales, issued 21 January 1840).

[605] It was this version that was illustrated in the first sheet of drawings of the 1840 specification.

transmitter. The transmitter worked by positioning a finger at the edge of a capstan on ‘a space behind the finger pin’ associated with the letter or number to be sent, and rotating the capstan until it reached an index. This action caused the mechanism behind it to make and break the circuit, sending an electrical impulse as each preceding character passed in front of the index. This was, in effect, an early version of the rotary dial used on future telephones. The two instruments had to be synchronised before transmission could proceed, and this was achieved when both dials pointed to the cross sign, which also signalled the end of transmission. Each letter of a word was followed by a short pause, and a new word was indicated by a pre-arranged sign.

The alarm was activated by a sensitive electromagnet that minimised the energy necessary to sound the alarm at the remote end, thus facilitating long distance operation. The operation of the alarm also allowed ring sequences and pauses to ‘convey prefatory information’.

Figure A 4.2. ABC instrument, 1840 specification. The device in the top row is the communicator (battery-operated). The bottom row shows a receiver that uses the alternative circular dial presenting the symbols in a small aperture. Photographed at Blythe House in September 2013, and reproduced with the kind permission of the Science Museum.

A magneto-electric machine was used in combination with an alarm, and it could also be used with a specially designed communicator – a manually powered transmitter which employed an arrangement of permanent and temporary magnets to generate the electrical impulses – and believed to be represented in Figure A 4.2. This much heavier apparatus had the advantage of requiring little, if any maintenance, unlike the battery-operated communicator described in the first sheet of drawings.

Figure A 4.3. Magneto-Electric ABC Instrument, 1840 specification. Photographed at Blythe House in September 2013, and reproduced with the kind permission of the Science Museum.

Wheatstone filed this second patent himself on 21 January 1840 and enrolled six months later under the heading 'Wheatstone and Cooke Specification', which underscored the prominence of the former in this patent. This specification is the first comprehensive description of an ABC telegraph. Mr Quételet of the Royal Observatory of Brussels presented Wheatstone's instrument to the Académie des Sciences on 17 October 1840, describing it as being capable of operating at up to 30 characters per minute, small enough to be carried in a box less than half a cubic meter, and costing less than £25.[606] L'abbé Moigno later recalled the description made by Quételet:

> Deux cadrans circulaires, placés aux deux stations extrêmes, et mis en rapport au moyen de deux fils conducteurs isolés, portent les diverses lettres de l'alphabet. En amenant successivement les lettres devant un indicateur au moyen d'un cadran d'où partent les signaux, on fait que ces mêmes lettres se reproduisent instantanément devant un indicateur semblable sur le cadran où les signaux sont reçus.[607]

Technological improvements

Five years after the 1840 specification, Wheatstone and Cooke embarked for the last time in a joint patent venture.[608] Wheatstone's electrical engineering expertise can be seen throughout these thirteen improvements, which dealt essentially with railway applications, although some of these improvements were also applicable to private telegraphy. These included the use of soft iron in the multiplying coils of needles to improve their sensitivity, single wire operation using earth return and electrical derivation to connect intermediate instruments without disrupting the circuit, the use of two electromagnets instead of one to make the alarm more efficient, and the use of an electromagnet instead of a permanent magnet in the magneto-electric generator for greater effect. Wheatstone's affinity with music and acoustics is reflected in an

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[606] Wheatstone, *A Reply to Mr Cooke's Pamphlet 'The Electric Telegraph, Was It Invented by Professor Wheatstone?'*, 17–18, 22.

[607] Moigno, *Traité de Télégraphie Electrique, renfermant son Histoire, sa Théorie et la Description des Appareils*, 96. ('Two dials, placed at the extremities of two conducting wires, display the letters of the alphabet. By bringing successively the letters in front of an indicator on the transmitting dial, these letters are reproduced instantly in front of a similar indicator on the receiving dial').

[608] Charles Wheatstone and William Fothergill Cooke, A.D. 1845, No. 10,655 [Improvements in electric telegraphs and in apparatus relating thereto, part of which improvements are applicable to other purposes], 10655 (England & Wales, issued 6 May 1845).

innovation that consisted in the addition of differentiated clicking sounds to each needle's operation to provide audio feedback during the visual task of writing down a message. The specification also included the use of coded sequences to send and receive alphanumeric characters with only two needles and two finger keys, and the transformation of the intermediate instrument into a circuit tester by replacing needles with a highly sensitive galvanometer.

Figure A 4.4. ABC instrument, 1860 specification. This instrument is stamped GPO but is likely to be one designed according to the 1860 specification. Photographed at Blythe House in September 2013, and reproduced with the kind permission of the Science Museum.

A commercially viable instrument

The next two patents were filed on 2 June 1858, after a gap of thirteen years. The first one described an automatic printing telegraph, which introduced the concept of pre-recorded messages and their transmission to a remote printer or recorder.[609] This innovative telegraph comprised four elements: a first instrument for transferring the messages to be sent into perforated ribbons or long strips of paper, a second instrument for reading the double row of codes punched on the strips of paper and transmitting these codes over telegraphic wires, a third instrument for receiving and printing the messages on strips of paper at the receiving station, which could serve as input to a fourth instrument to convert telegraphed codes into ordinary alphabetic characters.[610] To the perforator, transmitter, printer and translator, as these instruments were called, was added another device transforming the messages written on ribbons of paper into electric signals that could be transmitted to needle telegraphs either separately or in conjunction with the printing operation. It is noteworthy to mention that the transmitter was able to operate on one or two wires, as the 'single wire earth return' system was now widely understood and implemented, although there were still reasons to use two wires to improve the quality of transmission in some cases.

Wheatstone presented the automatic printing telegraph to the French Academy of Science on Monday, 24 January 1859.[611] During this lecture, he mentioned that the

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[609] Charles Wheatstone, A.D. 1858, No. 1239 [Improvements in electric telegraphs, and in apparatus connected therewith], 1239 (England & Wales, issued 2 June 1858). It should be noted that the use of punched paper as a storage element was not new, but an application of its well-known principle. Wheatstone's friend, Charles Babbage, had used the concept in the Analytical Engine, having done so after being inspired by the Jacquard loom, patented in England by Stephen Wilson in 1821. Charles Babbage, *Passages from the Life of a Philosopher* (London: Longman, Green, Longman, Roberts, & Green, 1864), 116.

[610] There were three rows of punched holes on the ribbons: the middle row controlled the motion of the paper and marked the intervals between the letters, while the left and right rows represented the actual letters (or special characters).

[611] 'Télégraphe Automatique Écrivant', *Comptes Rendus Hebdomadaires Des Séances de l'Académie Des Sciences* 48 (1859): 214–20.

machine was able to print at a speed of 500 characters per minute. It is clear from his notes that this machine was best suited and intended for newspapers and the media industry in general. The perforator, designed as a separate and portable low-cost machine, was envisioned from its inception to be used by newspapers within their premises, where news feed in any language could be punched on ribbons of papers before their transmission to more expensive but mutualised telegraphic facilities where they could be broadcasted across the country.

The second patent filed on 2 June 1858 referred to the ABC instrument first specified in the joint patent of 1840.[612] The first part of the patent related to enhancements designed to make the step-by-step operation quicker and more reliable than the 1840 instrument. The second part was about the communicator itself, and involved a new rotary dial as well as improvements to the magneto-electric generator – the rotating armature which had to be turned by the operator to operate the instrument (for those instruments that did not employ a voltaic battery). The third part was about improvements to the alarm mechanism, and in this particular model its operation was controlled through a two-position switch on the communicator: in idle mode the switch was always put in the 'A' position, which allowed the turning of the crank to sound the alarms; once the remote operator had acknowledged the signal (also by turning the crank on his own device), the switches were put in the 'T' position: the transmitting operator then simply pressed a tongue of brass (resembling a key) opposite the desired letter to release the capstan until a pointer reached that particular key. Pressing another

[612] Charles Wheatstone, A.D. 1858, No. 1241 [Improvements in electro-magnetic telegraphs and apparatus used for transmitting signs or indications to distant places by means of electricity], 1241 (England & Wales, issued 2 June 1858).

key caused the pointer to rotate to the next character and so on. The receivers had a smaller dial, similarly marked, on which a hand showed the letters being transmitted or received.

The specification also described the construction of two new instruments. The first instruments was an 'electromagnetic telegraphic clock' or 'sympathetic clock' resembling a step-by-step telegraph, but with the dial marked with hours and minutes instead of alphabetic letters.[613] The second instrument was a variant of the sympathetic clock: instead of receiving the time, this machine was counting or registering remote events, such as the motions of machines, or the opening of doors. Both of these machines were using voltaic batteries.

> Since then [1840], Professor Wheatstone has devoted much time to the improvement of this class of telegraphs [dial telegraphs]; the principal object of which has been to effect their movements with greater steadiness, certainty, and rapidity than hitherto, and by means of magnets of small dimensions. As the instruments are at present constructed, a lady or a child may, after a few minutes' instruction, send or receive a message by them; and, with practice, as many signals may be conveyed per minute as by any telegraphs in present use. Especially applicable to house-top

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[613] On 26 November 1840 Wheatstone had already presented a paper describing an electro-magnetic clock that moved the seconds hand with the activation of an electromagnet. A 'standard' clock powered by a voltaic battery provided the electrical impulses, and any number of electro-magnetic instruments could be brought into sympathetic action with it. Its use in an astronomical laboratory was provided as an illustration, whereby every room's clock was synchronised with the central astronomical clock. Charles Wheatstone, 'Description of the Electro-Magnetic Clock', *Proceedings of the Royal Society of London* 4 (26 November 1840): 249–50. This paper brought him into conflict with Alexander Bain who claimed to have invented the 'electric clock', a device he had apparently presented to Wheatstone in August 1840, but not patented until 7 December 1841. The device used an earth battery, which was also claimed by Bain to be an original concept, although he may not have been aware that, according to Dawson, the use of the earth as an electrical return had already been demonstrated by Professor Karl A. Steinheil in 1838. Dawson, 'The Early History of Electro-Magnetic Telegraph Instruments', 512. This controversy could not have happened at the worse time for Wheatstone who was at the time embroiled in the dispute with Cooke. Alexander Bain and John Finlaison, *An Account of Some Remarkable Applications of the Electric Fluid to the Useful Art with a Vindication of His Claim to Be the First Inventor of the Electro-Magnetic Printing Telegraph and Also of the Electro-Magnetic Clock* (London: Chapman and Hall, 1843), 36.

> telegraphs, they are more efficient than any others for interchanging messages on railways, in public offices, manufactories, private mansions, docks, mines, &c.[614]

The final patent was filed on 10 October 1860, a few months before the establishment of the Universal Private Telegraph Company.[615] These were improvements to the ABC instrument (see Figure A 4.3.). The rotary dial became more sophisticated and easier to use, the magneto-electric generator produced four or more electrical impulses in a single rotation depending on the number of magnets employed, which made the machine more efficient. The specification demonstrates once more the influence of Wheatstone's background as a music instrument maker as it also contains the description of a single-needle instrument that employed musical pipes such as the ones used on the concertina to produce differentiated sounds from two reservoirs of air, to 'listen' to Morse code. The transmitter of the automatic printing telegraph was also modified to receive inputs from a Morse receiver in order to print the successive long and short marks of the Morse code on the ribbons of paper, instead of the double row of dots utilised in the 1858 patent. A new scientific instrument was introduced in the shape of a 'telegraphic thermometer', capable of indicating to a distant station when the temperature reached one the two thresholds physically programmed on the device with the use of two pointers on a circular dial calibrated in degrees.[616]

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[614] Dickens, 'House-Top Telegraphs', 108.

[615] Charles Wheatstone, A.D. 1860, No. 2462 [Improvements in electro-magnetic telegraphs and apparatus for transmitting signs or indications to distant places by means of electricity, and in the means of and apparatus for establishing electric telegraphic communication between distant places, 2462 (England & Wales, issued 10 October 1860).

[616] This instrument was a significant improvement over the previous version of the telegraph thermometer. On 17 August 1843, Wheatstone delivered a paper in which he described a

Crucially, the last two improvements of this specification dealt with the urban infrastructure of telegraphic communication and the installation of wires over houses and streets. In this proposed multi-tenant aerial cabling system, straining poles were erected at the tops of public buildings or private houses to form, more or less, equilateral triangles joined side to side, approximately one mile apart. Two strong wires were extended across these poles, on which was hung a rope consisting of a bundle of 20 to 60 individually insulated metallic wires. At the level of the posts, the single wires were connected to a junction box where wires could be interconnected to establish electric circuits towards particular houses or buildings. The triangular configuration was limited to areas of high density of telegraphic communication traffic to ensure the economic viability of the system. The height of the posts was variable, and iron rods were sometimes used to support the rope as it crossed a street or other expanse. A cylinder of vulcanised India-rubber was interposed between the support and the telegraphic wires to reduce the vibrations caused by the wind. This cabling system was a crucial component of private telegraphy.

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device weighting approximately four pounds, and intended to be carried in a balloon. The movement was based on a small clock which caused a vertical rack to ascend and descend at constant speed. Two fine insulated copper wires were connected on the ground with a galvanometer and a voltaic element. The needle of the galvanometer deviated as soon the extremity of one of the wires made contact with the mercury bulb in the device. Using a chronometer initially synchronised with the instrument's clock, an operator on the ground had to note the instant the needle moved, and then extrapolate manually the temperature. The device was tested successfully in Woolwich by Colonel Sabine. The balloon was 18 feet in diameter, 25 feet high, and reached a height of 'some' miles. Charles Wheatstone, 'Description of the Telegraph Thermometer' (London: British Association for the Advancement of Science, 1844), 128–29.

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